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BALANCED TECHNOLOGY INITIATIVE BRIEFING TO INDUSTRY(U)  
OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE  
(RESEARCH AND ADVANCED TECHNOLOGY WASHINGTON DC

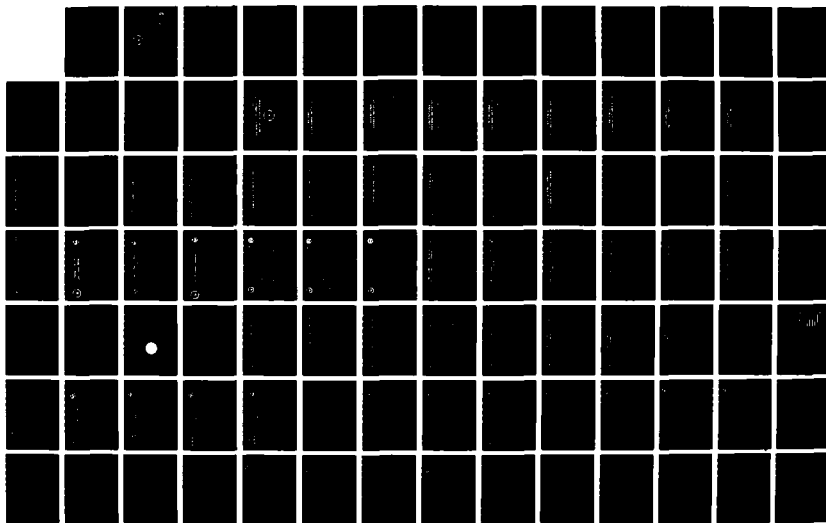
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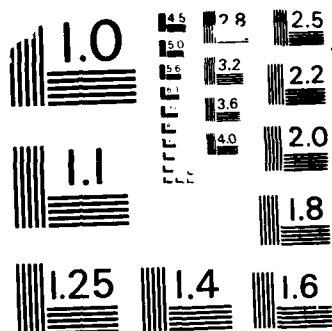
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# BALANCED TECHNOLOGY INITIATIVE BRIEFING TO INDUSTRY

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18. surveillance, target acquisition, target recognition, command and control systems, battle management, RSTA/BMC3, armor/antiarmor, microwaves, high power microwaves, HPM (high power microwaves)

19. obtaining, processing, transmitting, and using information essential to the effective deployment and utilization of conventional defense resources; Armor/Anti-armor Technology, intended to be both complementary and supplementary to the recently established cooperative DARPA/Army/Marine Corps program in this area; and High Power Microwaves (HPM), intended to develop a comprehensive understanding of the effects of HPM on tactical weapons systems to assure the survivability of U.S. assets and to place potentially vulnerable enemy systems at risk. In addition, a number of important projects not identifiable with the major thrust areas, but considered to have significant potential for enhancing conventional defense capabilities were included under a fifth category titled Special Technology Opportunities. This briefing highlights the differences between the Conventional Defense Initiative and the Balanced Technology Initiative and also provides descriptions of the BTI program categories, as well as five year funding profiles for specific projects within each category.



## TABLE OF CONTENTS

<b>AGENDA</b>	<b>Page</b>	
	1	
<b>INTRODUCTION</b>	3	
<b>ARMY PROJECTS</b>	31	
JOINT IR/LASER SEEKER	34	
DIGITAL TOPOGRAPHIC SUPPORT SYSTEM	39	
AIDED TARGET RECOGNITION	42	
COMBAT VEHICLE COMMAND AND CONTROL	48	
LIQUID PROPELLANT GUN	53	
COILGUN TECHNOLOGY DEVELOPMENT	58	
COMMAND ADJUSTED TRAJECTORY	63	
GROUND LAUNCHED HELLFIRE	68	
HIGH POWER MICROWAVES	71	
TACTICAL MISSILE INTERCEPTOR TECHNOLOGY	74	
<b>NAVY PROJECTS</b>	77	
HIGH PERFORMANCE INFRARED SEEKER	79	
SUBMARINE ANTI-TORPEDO WEAPON	82	
UNDERSEA SURVEILLANCE	85	
TARGET ACQUISITION FOR SHIP DEFENSE	88	
FIBER OPTICAL DATA LINK FOR AIR LAUNCHED WEAPONS	91	
FOLLOW THROUGH TORPEDO WARHEAD	93	
AMPHIBIOUS ASSAULT COUNTERMINE SYSTEM	97	
HIGH POWER MICROWAVES	100	
HIGH ENERGY LASER FOR SHIP DEFENSE	103	



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## AIR FORCE PROJECTS

MILLIMETER WAVE SEEKER DEMONSTRATION	107
AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS	109
MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY	111
HIGH POWER MICROWAVES	115
CRUISE MISSILE ADVANCED GUIDANCE	118
ADVANCED CLOSE AIR SUPPORT	121
	124

## DEFENSE AGENCY PROJECTS

127

### DARPA

MULTI-MISSION SEEKER DEVELOPMENT	131
AUTOMATIC TARGET RECOGNITION FOR SMART WEAPONS	132
DEEP BATTLE WEAPON CONCEPT	135
GUIDED TACTICAL HYPERVELOCITY PROJECTILES	136
MONOLITHIC INFRARED FOCAL PLANE ARRAYS	139
EXPERT SYSTEM FOR MANUFACTURE OF SMART WEAPON COMPONENTS	142
TACTICAL USE OF NATIONAL TECHNICAL MEANS	145
OPTICAL SIGNAL PROCESSING TECHNOLOGY	146
ENHANCED KINETIC ENERGY WEAPONS	149
ADVANCED COMPOSITE GUN	152
SHORT RANGE ANTI-TANK WEAPON	155
ADVANCED MINE/COUNTERMINE TECHNOLOGY	157
ARMOR MATERIALS	160
ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPONS	163
SYSTEM DEVELOPMENT	
PENETRATOR/TARGET INTERACTION FLASH X-RAY FACILITY	166
ADVANCED SHORT TAKEOFF/VERTICAL LANDING TECHNOLOGY	167
ACTIVE OPTICAL COUNTERMEASURES	169
HIGH POWER/ENERGY DENSITY BATTERIES	172
SUPERCONDUCTING CERAMIC MATERIALS	175



DEFENSE PRODUCTION ENGINEERING SERVICES OFFICE

INFRARED FOCAL PLANE ARRAY PRODUCTIBILITY INITIATIVE 178

DEFENSE NUCLEAR AGENCY

HIGH POWER MICROWAVES 181

OUSD (OFFICE OF MUNITIONS)

ENHANCED BLAST MUNITIONS TECHNOLOGY BASE DEVELOPMENT 182



## **AGENDA**

### **INTRODUCTION**

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### **BTI OVERVIEW**

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### **AIR FORCE BTI PROGRAM**

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**DIRECTOR, DEFENSE SCIENCE OFFICE**







# **INTRODUCTION**

## **BALANCED TECHNOLOGY INITIATIVE**



## **INTRODUCTION**

Two initiatives to focus increased attention on the enhancement of U.S. and Allied conventional defense capabilities were established by the 99th Congress. The Conventional Defense Initiative (CDI) was created "to provide an emphasis on improving the conventional weapons of the Armed Forces (and the testing of such weapons) and to enhance cooperation with the other member nations of the North Atlantic Treaty Organization." This latter objective is also being promoted by the NATO Cooperative Research and Development Program initiated in FY 1986. The Balanced Technology Initiative (BTI) was created to provide additional support for the development of "promising new technologies that could substantially advance our conventional defense capabilities." The two programs are intended to be complementary efforts that provide both near-term and long-term contributions to the effectiveness of conventional forces.

Specific projects to be included in the Conventional Defense Initiative program were identified by Congress. These efforts included 10 projects to be carried out by the Army and the continuation of NATO cooperative work initiated in FY 1986 by the Navy. Funds for these activities were appropriated directly to the responsible Services. Responsibility for the development of program details for the Balanced Technology Initiative was assigned to the Defense Research and



Engineering organization. Funds for this program were appropriated to the Office of the Secretary of Defense (OSD) for subsequent apportionment to the Services and the Defense Agencies.

As stated in Section 222 of the National Defense Authorization Act for Fiscal Year 1987, the Balanced Technology Initiative was established to "expand research on innovative concepts and methods of enhancing conventional defense capabilities" and for related research to facilitate "restoration of the conventional defense technology base." A detailed and substantive program plan has recently been developed that is consistent with those Congressional directives. This program plan has been described in detail in a classified report entitled "The Department of Defense Report on the Balanced Technology Initiative (U)", May 1987, prepared for submission to Congress. The report will be available later this year from the Defense Technical Information Center (DTIC), Cameron Station, Alexandria, Virginia 22304-6144. The purpose of this Briefing to Industry document is to provide an unclassified description of the BTI program to potential program participants.

### **BTI PROGRAM PLANNING PROCESS**

A special planning committee, chaired by the Deputy Under Secretary of Defense for Research and Advanced Technology, was established to develop the Balanced Technology Initiative



program. The committee included representatives from the Research and Advanced Technology, Tactical Warfare Programs, Strategic and Theater Nuclear Forces, and International Programs and Technology organizations within the Office of the Under Secretary of Defense for Acquisition; and from the Office of the Under Secretary of Defense for Policy, the Defense Advanced Research Projects Agency (DARPA), the Strategic Defense Initiative Organization (SDIO), and the Organization of the Joint Chiefs of Staff.

Numerous projects for the BTI program were nominated by appropriate technical experts who are members of the organizations named above. These projects covered a broad range of activities, including advanced weapons concepts and important technology base work. Candidate project areas suggested by SDIO were presented as technology spinoff opportunities derived from recent SDI developments that clearly have relevance to conventional defense problems. These suggestions included projects in the areas of hypervelocity guns and projectiles, software development tools and secure software engineering, advanced electronic materials, high power microwave devices and damage models, high performance multiprocessors, advanced sensors and seekers, tactical lasers, communications systems components and security, intelligence interfaces, and kinetic energy and laser weapon lethality prediction and evaluation. The BTI program plan includes work in a number of these areas.



In addition, many other candidate projects were recommended by the Services. Specific BTI program recommendations and priorities were formally requested through the Assistant Secretary of the Army for Research, Development and Acquisition; the Assistant Secretary of the Navy for Research, Engineering and Systems; and the Assistant Secretary of the Air Force for Research, Development and Logistics. Extensive interactions between the committee and the Services representatives followed. Written program recommendations were received in late November 1986 and subsequently reviewed by the committee. Service briefings on these recommendations were presented in December 1986, and in January 1987. These briefings described the selection process and prioritization criteria used by each Service, and also provided requested information on related work in progress, program continuity beyond FY 1987, and coordination of proposed BTI projects with the other Services.

Overall, approximately 250 candidate projects nominated by OSD organizations, Defense Agencies, and the Services were considered in developing a detailed plan for the BTI program. The total FY 1987 cost of these candidate projects was more than \$2 billion. Guidelines were developed to aid in the evaluation and selection process. Projects were required to be consistent with the intent of Congress as stated in Section 222 of the National Defense Authorization Act for Fiscal Year 1987. Emphasis was given to technology areas that addressed recognized critical conventional force needs; chemical, biological, and nuclear programs were generally excluded. Projects offering



both near-term and longer-term potential for enhancing conventional force capabilities were also emphasized. Preferred candidates were considered to include projects complementary to ongoing work that offered the possibility of high payoff in military effectiveness through additional funding. Joint programs (e.g., DARPA/Services, multi-Service, or involving international cooperation) were encouraged. Finally, emphasis was given to projects supporting a limited number of thrust areas for the overall program. The intent of this guideline was to assure that the BTI program could "make a difference" in a few technology areas critical to conventional defense missions.

### BTI Program Categories

Four thrust areas were developed for the program: Smart Weapons Technology, intended to promote the advancement of technologies that can ultimately provide significant improvements in target acquisition and destruction capabilities for a broad range of munitions; RSTA/BMC3 Technology, a category merging two widely used acronyms (RSTA - for Reconnaissance, Surveillance, and Target Acquisition; and BMC3 - for Battle Management, Communications, Command, and Control) that addresses enabling technologies for obtaining, processing, transmitting, and using information essential to the effective deployment and utilization of



conventional defense resources; Armor/Anti-Armor Technology, intended to be both complementary and supplementary to the recently established cooperative DARPA/Army/Marine Corps program in this area; and High Power Microwaves (HPM), intended to develop a comprehensive understanding of the effects of HPM on tactical weapons systems to assure the survivability of U.S. assets and to place potentially vulnerable enemy systems at risk. In addition, a number of other important projects were also included in the program in a fifth category called Special Technology Opportunities. These projects were not identifiable with the major thrust areas but were considered to have significant potential for enhancing conventional defense capabilities. Descriptions of all of the 48 projects included in the BTI program are provided in the report to Congress, together with information related to milestones and funding. Total funding in the amount of \$182 million has been allocated for these projects in FY 1987.

The following charts highlight the differences between the Conventional Defense Initiative and the Balanced Technology Initiative and also provide descriptions of the BTI program categories. Specific projects within each category, together with five year funding profiles for each project prepared in accordance with Congressional direction, are listed in the accompanying tables. It should be noted that the figures given for individual projects represent reasonable estimates considered appropriate for research and technology development efforts. However, actual figures



could changes as a result of program reviews and reevaluation of detailed work plans on a yearly basis.



**DEPARTMENT OF DEFENSE  
BALANCED TECHNOLOGY  
INITIATIVE PROGRAM**



---

**DR. WILLIAM E. SNOWDEN  
SPECIAL ASSISTANT  
TO  
DUSD (R&AT)**





# **RECENT U.S. DEFENSE INITIATIVES**

---

## **STRATEGIC DEFENSE INITIATIVE (SDI)**

- ESTABLISHED BY PRESIDENT (1983)
- TECHNOLOGY DEVELOPMENT FOR BALLISTIC MISSILE DEFENSE

## **AIR DEFENSE INITIATIVE (ADI)**

- ESTABLISHED BY DEPARTMENT OF DEFENSE
- TECHNOLOGY DEVELOPMENT FOR AIR DEFENSE OF NORTH AMERICA (CMs, SLBMs, AIRCRAFT)

## **CONVENTIONAL DEFENSE INITIATIVE (CDI) BALANCED TECHNOLOGY INITIATIVE (BTI)**

- ESTABLISHED BY CONGRESS (1986)
- WEAPONS DEVELOPMENT/TESTING AND TECHNOLOGY DEVELOPMENT TO ENHANCE CONVENTIONAL DEFENSE CAPABILITIES





# **CONVENTIONAL DEFENSE INITIATIVE**

---

- **ESTABLISHED BY THE 99TH CONGRESS  
(FY 1987)**
- **CREATED "TO PROVIDE AN EMPHASIS ON  
IMPROVING THE CONVENTIONAL WEAPONS  
OF THE ARMED FORCES (AND THE TESTING  
OF SUCH WEAPONS) AND TO ENHANCE  
COOPERATION WITH THE OTHER MEMBER  
NATIONS OF THE NORTH ATLANTIC TREATY  
ORGANIZATION"**
- **\$47M APPROPRIATED DIRECTLY TO ARMY  
FOR 10 SPECIFIC PROJECTS**
- **\$30M APPROPRIATED DIRECTLY TO NAVY  
FOR NATO COOPERATIVE PROJECTS**





# **CONVENTIONAL DEFENSE INITIATIVE**

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## **ARMY CDI PROJECTS (1987)**

- **GUARD-RESERVE UNIQUE R&D**
- **LIGHT ARMORED VEHICLE/WEASEL  
EVALUATION**
- **MINE FLAIL WHEELED VEHICLE**
- **GROUND LAUNCHED HELLFIRE**
- **STINGER SYSTEM SAFEGUARD**
- **TACTICAL RPV EVALUATION**
- **QUIET GENERATORS**
- **HELICOPTER AIR-TO-AIR MISSILE**
- **CLOSE-IN AIR DEFENSE**
- **MILAN II EVALUATION**

**FUNDS APPROPRIATED DIRECTLY TO ARMY ACCOUNTS**





# **CONVENTIONAL DEFENSE INITIATIVE**

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## **NAVY CDI PROJECTS (1987)**

- **NAVY ANTI-AIR-WARFARE SYSTEM**
- **NAVY SEA SPARROW SURFACE MISSILE SYSTEM**
- **ADVANCED SEA MINE**
- **NAVY IDENTIFICATION SYSTEM**
- **NAVY FRIGATE REPLACEMENT FOR THE 90S**
- **SURFACE SHIP TORPEDO DEFENSE**
- **INTERNATIONAL RDT&E SUPPORT**

**NAVY COOPERATIVE PROGRAMS  
FUNDS APPROPRIATED DIRECTLY TO NAVY ACCOUNT**





# **BALANCED TECHNOLOGY INITIATIVE**

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- **ESTABLISHED BY THE 99TH CONGRESS  
(FY 1987)**
- **INTENDED TO PROVIDE ADDITIONAL SUPPORT  
FOR THE DEVELOPMENT OF "PROMISING NEW  
TECHNOLOGIES THAT COULD SUBSTANTIALLY  
ADVANCE OUR CONVENTIONAL DEFENSE  
CAPABILITIES"**
  - TO "EXPAND RESEARCH ON INNOVATIVE CONCEPTS  
AND METHODS OF ENHANCING CONVENTIONAL  
DEFENSE CAPABILITIES"
  - TO FACILITATE "RESTORATION OF THE CONVENTIONAL  
DEFENSE TECHNOLOGY BASE"
- **\$200M APPROPRIATED TO OSD FOR  
APPORTIONMENT TO THE SERVICES AND  
THE DEFENSE AGENCIES**





# **BALANCED TECHNOLOGY INITIATIVE**

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## **PROGRAM PLANNING PROCESS**

- **CANDIDATE PROJECTS NOMINATED BY OSD ORGANIZATIONS, INCLUDING DEFENSE AGENCIES, AND SERVICES**
- **CRITERIA DEVELOPED TO AID IN EVALUATION OF MORE THAN 250 PROJECTS SUGGESTED**
- **EVALUATION/SELECTION PROCESS CARRIED OUT UNDER PRINCIPAL DIRECTION OF DUSD (R&AT)**
- **5 PROGRAM CATEGORIES ESTABLISHED: INTENDED TO "MAKE A DIFFERENCE" IN A FEW TECHNOLOGY AREAS CRITICAL TO CONVENTIONAL DEFENSE MISSIONS**





# **BALANCED TECHNOLOGY INITIATIVE**

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## **SDI TECHNOLOGY SPINOFF OPPORTUNITIES**

- **HYPERVELOCITY GUNS AND PROJECTILES**
- **OPTICAL AND RF SENSORS**
- **BMC3 SYSTEMS/COMPONENTS**
- **HIGH POWER MICROWAVES (HPM)**
- **LASERS FOR TACTICAL UTILITY**
- **KINETIC ENERGY AND LASER  
WEAPONS LETHALITY**
- **SOFTWARE DEVELOPMENT TOOLS**
- **ADVANCED ELECTRONIC MATERIALS**





# **BALANCED TECHNOLOGY INITIATIVE**

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## **PROGRAM CATEGORIES**

- **SMART WEAPONS TECHNOLOGY**
- **RSTA/BMC3 TECHNOLOGY**
- **ARMOR/ANTI-ARMOR TECHNOLOGY**
- **HIGH POWER MICROWAVES (HPM)**
- **SPECIAL TECHNOLOGY OPPORTUNITIES**





**TABLE 1. BTI PROGRAM CATEGORIES  
AND FUNDING PROFILES**

CATEGORY	FUNDING (\$ MILLIONS)				
	<u>FY 87</u>	<u>FY 88</u>	<u>FY 89</u>	<u>FY 90</u>	<u>FY 91</u>
SMART WEAPONS TECHNOLOGY	50	76	126	150	105
RSTA/BMC3 TECHNOLOGY	47	77	101	88	70
ARMOR/ANTI-ARMOR TECHNOLOGY	36	57	95	77	64
HIGH POWER MICROWAVES	15	15	20	*	*
SPECIAL TECHNOLOGY OPPORTUNITIES	34	63	51	64	54
TOTALS	182	288	393	379	293

\* FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED





## **BALANCED TECHNOLOGY INITIATIVE SMART WEAPONS TECHNOLOGY**

**OVERALL OBJECTIVE: TO ACCELERATE DEVELOPMENT OF TECHNOLOGIES OF CRITICAL IMPORTANCE TO NEXT-GENERATION FIRE-AND-FORGET, AUTONOMOUS WEAPONS EMPLOYED BY CONVENTIONAL FORCES**

- **IMPROVE TARGET ACQUISITION, IDENTIFICATION, AND HIT CAPABILITIES; DEVELOP TARGET PRIORITIZATION SCHEMES**
- **FOR BOTH SHORT- AND LONGER-RANGE ENGAGEMENTS**
- **PROVIDE SIGNIFICANT FORCE-MULTIPLIER POTENTIAL**

### **PRINCIPAL PROJECT AREAS**

- **ADVANCED SENSORS/SEEKERS**
- **AUTONOMOUS GUIDANCE/AUTOMATIC TARGET RECOGNITION (ATR)**
- **PRODUCTIBILITY OF COMPONENTS**





**TABLE 2. SMART WEAPONS TECHNOLOGY:  
PROJECTS AND FUNDING PROFILES**

PROJECT	FUNDING (\$ MILLIONS)				
	FY 87	FY 88	FY 89	FY 90	FY 91
MILLIMETER WAVE (MMW) SEEKER DEMONSTRATION	4	6	12	15	*
HIGH PERFORMANCE INFRARED (IR) SEEKER	4	6	12	20	15
JOINT IR/LASER SEEKER	4	6	10	15	5
MULTI-MISSION SEEKER DEVELOPMENT	5	7	10	10	5
AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS	8	10	15	*	*
AUTOMATIC TARGET RECOGNITION (ATR) FOR SMART WEAPONS	5	8	12	15	10
SUBMARINE ANTI-TORPEDO WEAPON	6	8	12	20	15
DEEP BATTLE WEAPON CONCEPT	3	7	10	10	5
GUIDED TACTICAL HYPERVELOCITY PROJECTILES	6	10	15	20	20
MONOLITHIC IR FOCAL PLANE ARRAYS	1	3	6	10	10
EXPERT SYSTEMS FOR MANUFACTURE OF SMART WEAPONS COMPONENTS	2	5	12	15	20
IR FOCAL PLANE ARRAY PRODUCIBILITY	2	0	0	0	0
TOTALS	50	76	126	150	105

\*FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED





## **BALANCED TECHNOLOGY INITIATIVE RSTA/BMC3 TECHNOLOGY**

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**OVERALL OBJECTIVE: TO ADVANCE TECHNOLOGIES  
IMPORTANT IN OBTAINING, PROCESSING,  
PASSING AND USING INFORMATION VITAL TO  
MAXIMIZING BATTLEFIELD PERFORMANCE OF  
CONVENTIONAL FORCES**

- **INFORMATION CAN PROVIDE A STABILIZING  
EFFECT IN TIMES OF CRISIS**
- **ENHANCE PRE-CONFLICT POSTURING OF DEFENSE  
FORCES AND POST-ATTACK RETALIATORY  
CAPABILITIES (OFFENSIVE/DEFENSIVE)**
- **FIND, FIX, TARGET, AND ENGAGE ENEMY FORCES  
AND ASSETS**
- **PROMOTE HIGH LEVELS OF ECONOMY OF FORCE**

### **PRINCIPAL PROJECT AREAS**

- **SURVEILLANCE TECHNOLOGY**
- **TARGETING TECHNOLOGY**
- **INFORMATION MANAGEMENT**





**TABLE 3. RSTA/BMC3 TECHNOLOGY:  
PROJECTS AND FUNDING PROFILES**

PROJECT	FUNDING (\$ MILLIONS)				
	FY 87	FY 88	FY 89	FY 90	FY 91
UNDERSEA SURVEILLANCE	20	25	30	30	20
TACTICAL USE OF NATIONAL TECHNICAL MEANS (TACNAT)	5	8	11	0	0
DIGITAL TOPOGRAPHIC SUPPORT SYSTEM (DTSS)	3	3	0	0	0
TARGET ACQUISITION FOR SHIP DEFENSE	4	10	2	0	0
AIDED TARGET RECOGNITION	5	8	18	25	20
FIBER OPTIC DATA LINK FOR AIR LAUNCHED WEAPONS	3	6	8	*	*
COMBAT VEHICLE COMMAND AND CONTROL (CVC2)	2	7	14	10	7
OPTICAL SIGNAL PROCESSING TECHNOLOGY	3	7	15	20	20
MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY	2	3	3	3	3
<b>TOTALS</b>	<b>47</b>	<b>77</b>	<b>101</b>	<b>88</b>	<b>70</b>

\*FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED





## **BALANCED TECHNOLOGY INITIATIVE ARMOR/ANTI-ARMOR TECHNOLOGY**

---

**OVERALL OBJECTIVE: TO PROMOTE INCREASED  
SURVIVABILITY AND MORE EFFECTIVE  
RETALIATORY WARFIGHTING CAPABILITY FOR  
U.S. CONVENTIONAL FORCES**

- **EXPAND ONGOING WORK CONCERNED WITH THE  
DEVELOPMENT OF ADVANCED ARMOR AND ANTI-  
ARMOR WEAPONS SYSTEMS**
- **COMPLEMENTARY/SUPPLEMENTARY TO EXISTING  
DARPA/ARMY/USMC PROGRAM**
- **INCLUDES BOTH SYSTEM-SPECIFIC PROJECTS AND  
IMPORTANT TECHNOLOGY BASE ACTIVITIES**

### **PRINCIPAL PROJECT AREAS**

- **ADVANCED GUNS AND PROJECTILES**
- **ADVANCED WEAPONS**
- **MINE/COUNTERMINE TECHNOLOGY**
- **MATERIALS/PHENOMENOLOGY/MODELLING**





**TABLE 4. ARMOR/ANTI-ARMOR TECHNOLOGY:  
PROJECTS AND FUNDING PROFILES**

PROJECT	FUNDING (\$ MILLIONS)				
	FY 87	FY 88	FY 89	FY 90	FY 91
ENHANCED KINETIC ENERGY WEAPONS	3	6	12	10	5
LIQUID PROPELLANT GUN	2	6	8	*	*
ADVANCED COMPOSITE GUN	1	2	5	8	5
COILGUN TECHNOLOGY DEVELOPMENT	4	6	12	15	20
SHORT RANGE ANTI-TANK WEAPON (SRAW)	3	5	10	7	*
COMMAND ADJUSTED TRAJECTORY (CAT)	2	6	10	12	12
FOLLOW-THROUGH TORPEDO WARHEAD	2	2	3	5	5
GROUND-LAUNCHED HELLFIRE	3	8	10	*	*
ADVANCED MINE/COUNTERMINE TECHNOLOGY	5	5	10	15	12
AMPHIBIOUS ASSAULT COUNTERMINE SYSTEM	2	3	5	*	*
ARMOR MATERIALS	2	3	5	*	*
ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPON SYSTEM DEVELOPMENT	3	5	5	5	5
PENETRATOR/TARGET INTERACTION FLASH X-RAY FACILITY	4	0	0	0	0
TOTALS	36	57	95	77	64

\*FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED





## BALANCED TECHNOLOGY INITIATIVE **HIGH POWER MICROWAVES (HPM)**

---

**OVERALL OBJECTIVE: TO DEVELOP A  
COMPREHENSIVE UNDERSTANDING OF THE  
EFFECTS OF HPM ON TACTICAL WEAPONS  
SYSTEMS TO ENSURE SURVIVABILITY OF U.S.  
ASSETS AND TO HOLD POTENTIALLY VULNERABLE  
ENEMY SYSTEMS AT RISK**

- DETERMINE SUSCEPTIBILITY OF U.S. AND FOREIGN WEAPONS SYSTEMS AND COMPONENTS TO HPM
- DEVELOP HARDENING TECHNOLOGY REQUIRED TO INCREASE SURVIVABILITY OF U.S. ASSETS
- DEVELOP HPM WEAPONS TECHNOLOGY FOR POSSIBLE USE ON TACTICAL BATTLEFIELDS OF THE FUTURE

**WORK AREAS: EFFECTS TESTING, HARDENING,  
COMPONENTS DEVELOPMENT, PROPAGATION/  
PHENOMENOLOGY, AND METHODOLOGY**





**TABLE 5. HIGH POWER MICROWAVES:  
PROJECTS AND FUNDING PROFILES**

PROJECT	FUNDING (\$ MILLIONS)				
	<u>FY 87</u>	<u>FY 88</u>	<u>FY 89</u>	<u>FY 90</u>	<u>FY 91</u>
HPM EFFECTS TESTING	7	6	8	*	*
HPM HARDENING	1	2	3	*	*
HPM COMPONENTS DEVELOPMENT	4	4	6	*	*
HPM PROPAGATION/ PHENOMENOLOGY	2	2	2	*	*
HPM METHODOLOGY	1	1	1	*	*
TOTALS	15	15	20	*	*

\*FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED





**TABLE 6.**  
**SPECIAL TECHNOLOGY OPPORTUNITIES:**  
**PROJECTS AND FUNDING PROFILES**

PROJECT	FUNDING (\$ MILLIONS)				
	<u>FY 87</u>	<u>FY 88</u>	<u>FY 89</u>	<u>FY 90</u>	<u>FY 91</u>
TACTICAL MISSILE INTERCEPTOR TECHNOLOGY	13	32	20	20	20
HIGH ENERGY LASER FOR SHIP DEFENSE	2	3	0	0	0
ENHANCED BLAST MUNITIONS	2	3	8	*	*
ASTOVL TECHNOLOGY	5	0	0	0	0
ACTIVE OPTICAL COUNTERMEASURES (AOCM)	2	5	10	20	15
HIGH POWER/ENERGY DENSITY BATTERIES	2	3	3	4	4
SUPERCONDUCTING CERAMIC MATERIALS	2	5	10	20	15
CRUISE MISSILE ADVANCED GUIDANCE	3	7	*	*	*
ADVANCED CLOSE AIR SUPPORT TECHNOLOGY	3	5	*	*	*
TOTALS	34	63	51	64	54

\*FUNDING REQUIREMENTS HAVE NOT BEEN ESTABLISHED

90101





# **DOD SCIENCE AND TECHNOLOGY PROGRAM**

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- **FUNDED AT \$5.4 BILLION IN FY 1987**
- **KEY ELEMENTS OF PROGRAM**
  - **MILITARY SYSTEMS TECHNOLOGY (AERONAUTICS, PROPULSION, STRUCTURES, MATERIALS, ELECTRONICS, WEAPONS)**
  - **ENVIRONMENTAL SCIENCES**
  - **LIFE SCIENCES**
  - **ELECTRONIC DEVICES/VHSIC/MIMIC**
  - **COMPUTER SCIENCE**
  - **BASIC RESEARCH**
- **BTI PROGRAM: PROVIDES OPPORTUNITY TO INCREASE EMPHASIS IN A FEW IMPORTANT TECHNOLOGY AREAS CRITICAL TO CONVENTIONAL DEFENSE MISSIONS**



# ARMY BTI PROJECTS



## **ARMY BALANCED TECHNOLOGY INITIATIVE PROJECTS**

Army participation in the BTI Program for FY 1987 involves work on 10 projects funded at a total of \$41 million. Specific projects include the following:

JOINT IR/LASER SEEKER  
DIGITAL TOPOGRAPHIC SUPPORT SYSTEM  
AIDED TARGET RECOGNIZATION  
COMBAT VEHICLE COMMAND AND CONTROL  
LIQUID PROPELLANT GUN  
COILGUN TECHNOLOGY DEVELOPMENT  
COMMAND ADJUSTED TRAJECTORY  
GROUND LAUNCHED HELLFIRE  
HIGH POWER MICROWAVES  
TACTICAL MISSILE INTERCEPTOR TECHNOLOGY

Details regarding these projects are provided in the following charts.





# **BALANCED TECHNOLOGY INITIATIVE ARMY PROGRAMS**



## **SINGLE ARMY POC:**

**DR. LOUIS M. CAMERON  
DIRECTOR OF RESEARCH & TECHNOLOGY**

## **ALTERNATE:**

**MR. BRUCE B. ZIMMERMAN  
DEPUTY ASSISTANT DIRECTOR OF RESEARCH  
AND TECHNOLOGY (C4I/AI/ROBOTICS)**





# **JOINT IR/LASER SEEKER OVERALL OBJECTIVES:**

- TO RETAIN SEMI-ACTIVE LASER (SAL) CAPABILITIES IN THE NEXT GENERATION OF IR BASED AUTONOMOUS PRECISION MUNITION SYSTEMS, IN PARTICULAR COPPERHEAD II
- TO DEVELOP SAL/IR TECHNOLOGY POTENTIALLY APPLICABLE TO OTHER DoD WEAPON SYSTEMS, i.e. NAVY SAL PROJECTILES, MORTARS, HELLFIRE
- TO DESIGN, FABRICATE, TEST, AND DEMONSTRATE THROUGH PROOF OF PRINCIPLE A SAL/IR OPTION SUITABLE TO FSED AND INSERTION INTO COPPERHEAD PRODUCTION BY 1995

## ***RESPONSIBLE AGENCIES:***

- OSD
- U.S. ARMY ARDEC
- PAUL J. KISATSKY  
U.S. ARMY ARDEC  
(201) 724-3130

## ***PRINCIPAL POC:***





## *Semi-Active Laser Infrared (SAL/IR) Seeker*



### *Background:*

- NEED FOR IMPROVED SEEKER FOR 155MM COPPERHEAD PROJECTILE
- MINIMIZE DEPENDENCE ON "MAN-IN-THE-LOOP"
- RETAIN SAL CAPABILITY FOR SURGICAL STRIKES
- NEED FOR AUTONOMOUS OPERATION AGAINST MASS ATTACK

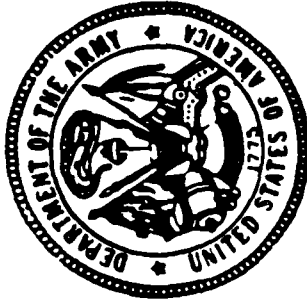
### *Status:*

- 2 CONTRACTORS SELECTED
- ANTICIPATED AWARD DATE 15 NOV 87





# *Planned SAL/IR Operational Modes*



## **REQUIRED**

- PRESET SAL MODE; COMPARABLE PERFORMANCE TO COPPERHEAD I
- PRESET IR MODE, COMPARABLE TO CURRENTLY PROJECTED 2CIR PERFORMANCE SPECS

## **DESIRED**

- DUAL MODE, SYNERGISTICALLY EMPLOYED TO IMPROVE PERFORMANCE OVER EITHER MODE USED INDIVIDUALLY





# ***Semi-Active Laser-Infrared (SAL/IR) Seeker Program Plan — 3 Phases — 4 Years***



## ***PHASE I DESIGN, BUILD, TOWER TEST (15 MO)***

- BREADBOARD SEEKER
- BRASSBOARD ELECTRONICS
- LAB TEST
- HIGH G ANALYSIS
- TOWER TEST SEEKER DEMONSTRATION

## ***PHASE II CAPTIVE FLIGHT TESTING/SYSTEM INTEGRATION (15 MO)***

- G-TEST CRITICAL COMPONENTS
- RAIL GUN SEEKER TEST
- INTEGRATION INTO COPPERHEAD AIRFRAME
- INTEGRATION OF AUTOPILOT AND GUIDANCE AND CONTROL
- CAPTIVE FLIGHT TESTING OVER REALISTIC SCENARIOS

## ***PHASE III PROJECTILE/SEEKER FLIGHT TEST (18 MO)***

- CAPTIVE FLIGHT TEST OF G-HARDENED SEEKER
- HARDWARE-IN-THE-LOOP TESTS WITH INTEGRATED SEEKER
- INTEGRATION OF TELEMETRY
- PROJECTILE/SEEKER FIRINGS





# ***SAL/IR Seeker Features***



- RESPONDS JOINTLY TO LASER DESIGNATED SIGNATURE AND INTRINSIC TARGET IR SIGNATURE
- CAN BE USED IN CONVENTIONAL OR AUTONOMOUS MODE
- CAN BE USED IN JOINT MODE FOR MAXIMUM RELIABILITY AND CM RESISTANCE
- WILL SERVE AS BASELINE TO PROVE VIABILITY OF AUTONOMOUS SEEKER WITHOUT GIVING UP "BIRD IN THE HAND"
- PROVIDES THE NECESSARY TRANSITION UNTIL ALL-UP AUTONOMY CAN BE DEMONSTRATED





# **DIGITAL TOPOGRAPHIC SUPPORT SYSTEM (DTSS)**



## **BTI OBJECTIVE**

- TO FACILITATE STARTUP OF DTSS FULL SCALE DEVELOPMENT

## **OVERALL PROGRAM OBJECTIVES**

- TO DEVELOP THE DTSS WHICH PROVIDES TERRAIN ANALYSIS INFORMATION IN MINUTES OR HOURS FOR DIVISIONS, CORPS AND HIGHER ECHELONS
- TO ESTABLISH STANDARDS FOR DIGITAL TERRAIN DATA AND DATA-ANALYSIS PRODUCTS
- TO ESTABLISH BASIS FOR AIRLAND BATTLEFIELD ENVIRONMENT (ALBE) AND ARMY/DARPA COMPUTER IMAGE GENERATION TECHNOLOGY IMPLEMENTATION
- TO DEVELOP THE QUICK RESPONSE MULTI-COLOR PRINTER (QRMP)

## **RESPONSIBLE AGENCIES**

- JOINT TACTICAL FUSION PROGRAM OFFICE (JFTPO)
- U.S. ARMY ENGINEER TOPOGRAPHIC LABORATORIES (USAETL)

**PRINCIPAL POC: MR. BRUCE K. OPITZ, USAETL, (202) 355-2850**

**ALTERNATE POC: MR. FRANCIS G. CAPECE, USAETL, (202) 355-2854**





# **DIGITAL TOPOGRAPHIC SUPPORT SYSTEM (DTSS)**



## **PROGRAM BACKGROUND AND STATUS**

- **LETTER OF AGREEMENT RECOGNIZES NEED TO REPLACE MANUAL, LABOR INTENSIVE PROCESS WITH RAPID TERRAIN DATA/PRODUCT SUPPORT SYSTEM FOR ARMY TERRAIN TEAMS IN JAN 82**
- **AUTOMATED TERRAIN ANALYSIS DEVELOPED IN-HOUSE AT USAETL**
- **SINGLE PHASE ACQUISITION STRATEGY APPROVED VICE CHIEF OF STAFF ARMY IN DEC 85**
- **FIELD DEMONSTRATIONS OF CAPABILITIES FROM OCT 85 TO JUN 87**
- **REQUIRED OPERATIONAL CAPABILITY (ROC) APPROVED OCT 86**
- **FULL SCALE ENGINEERING DEVELOPMENT (FSED) APPROVED JUN 87**
- **FSED CONTRACT AWARD JUL 87**
- **ADVANCE DEVELOPMENT MODEL OF QRMP TESTED**
- **ROC FORMALIZING NEED FOR QRMP APPROVED DEC 86**





# **DIGITAL TOPOGRAPHIC SUPPORT SYSTEM (DTSS)**



## **MAJOR PROGRAM ELEMENTS**

- **DEVELOP AN INTEGRATED TERRAIN ANALYSIS SOFTWARE PACKAGE**
- **DEVELOP A MAN-MACHINE INTERFACE FOR TERRAIN ANALYST**
- **INTEGRATE HARDWARE AND SOFTWARE INTO A FIELDABLE SYSTEM**
- **FIELD TO TERRAIN TEAMS STARTING IN 1992**
- **INITIATE DEVELOPMENT OF THE QRMP**





# SECOND GENERATION SIGNAL PROCESSING EQUIPMENT



**TITLE: MULTI-FUNCTION TARGET ACQUISITION PROCESSOR (M-TAP)**

**OBJECTIVE: TO EXPLOIT THE AUTOMATIC TARGET ACQUISITION  
CAPABILITIES AFFORDED BY INTEGRATING SECOND  
GENERATION FLIR TECHNOLOGY WITH ADVANCED IMAGE  
PROCESSING ALGORITHMS & EMERGING PROCESSING  
DEVICES**

**APPROACH:**

- **DESIGN AND TEST THROUGH SIMULATION THE M-TAP ALGORITHMS**
- **PRODUCE AN M-TAP DEMONSTRATION UNIT WITH INSTRUMENTATION  
CAPABILITY FOR TESTING IN REAL TIME**
- **VALIDATE TECHNOLOGY MATURITY THROUGH LAB AND FIELD TESTS**
- **INTEGRATE WITH SECOND GENERATION SENSOR (SAIRS) FOR  
TECHNOLOGY DEMONSTRATION**
- **UNDERSTAND IN REAL-TIME ALGORITHM OPERATION**
- **FRAME TO FRAME INFORMATION USED IN TRACKING**
- **PROCESSOR WILL ACCEPT FEATURES FROM ADDITIONAL SENSORS**





# MULTISENSOR FEATURE FUSION



**OBJECTIVE: DEMONSTRATE AND EVALUATE TARGET ACQUISITION  
ALGORITHMS BASED ON FUSION OF MULTISENSOR FEATURES**

**APPROACH:**

- ESTABLISH FEASIBILITY IN SIMULATION OF FLIR WITH LADAR/MMW  
RADAR
- INTEGRATE ALGORITHM SUITES INTO NEAR REAL TIME HARDWARE
- EVALUATE PERFORMANCE IN FIELD TESTS

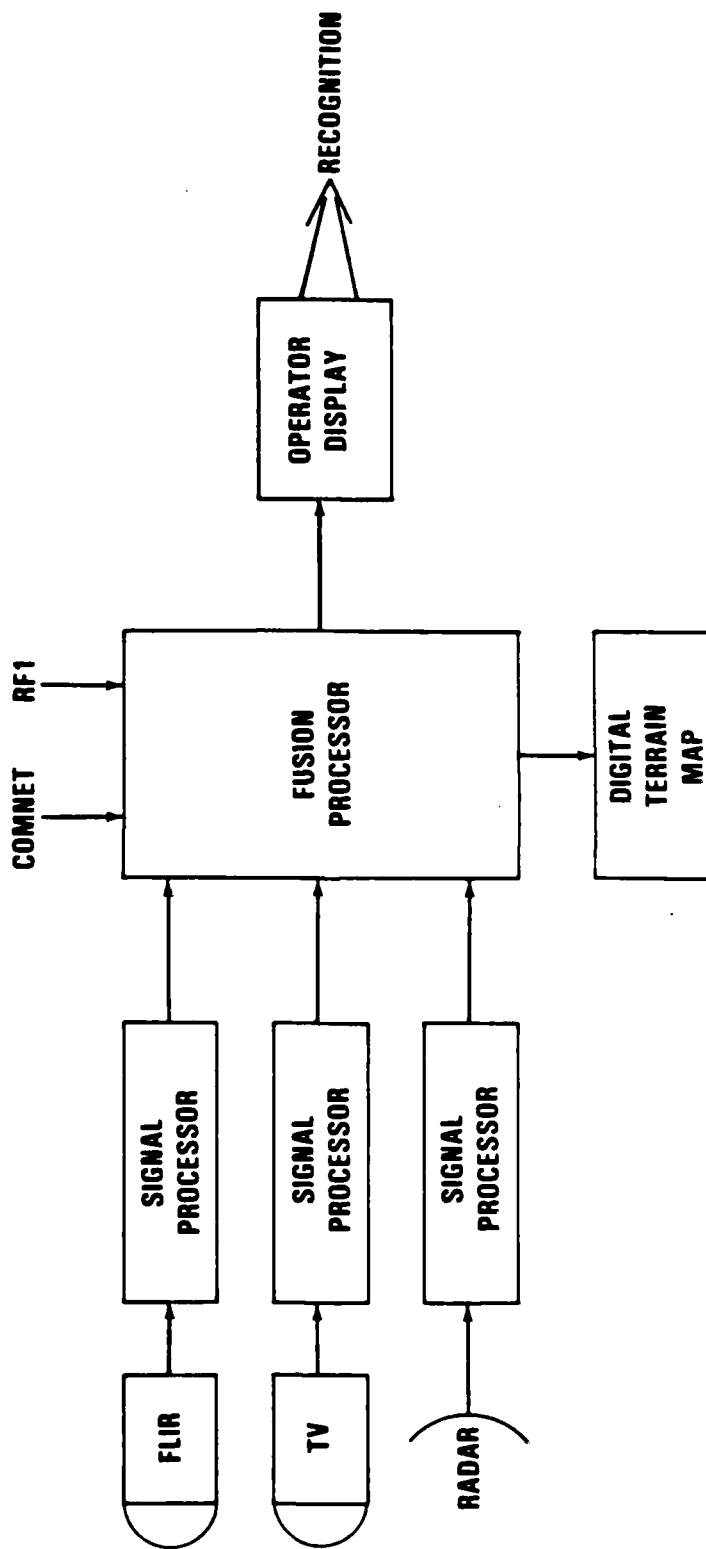
**APPLICATION:**

- PROVIDE AUTOMATIC TARGET RECOGNITION FOR LHX UPGRADE, AFV  
AND FUTURE ARMY WEAPONS SYSTEMS





# MULTI-SENSOR FUSION CONCEPT







# **AIDED TARGET RECOGNITION TECHNOLOGY**



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## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **DIGITAL HARDWARE DEVELOPMENT**
- **PARALLEL ARCHITECTURES**
- **OPTICAL SIGNAL PROCESSING**
- **TARGET AND BACKGROUND MODELS (ANALYTIC)**
- **ALGORITHM SIMULATORS**
- **ANALYTIC PERFORMANCE MODELS**
- **PERFORMANCE MEASURES (METRICS)**
- **TEST TECHNIQUES**
- **DEMONSTRATION OF MULTI-SENSOR SYSTEMS.**





# **AIDED TARGET RECOGNITION TECHNOLOGY**



## **REPRESENTATIVE ATR CAPABILITIES OF INTEREST TO DOD**

- **REAL-TIME IMAGE PROCESSING HARDWARE**
- **ALGORITHMS WHICH AUTOMATICALLY FIND TARGETS FOR CUEING AN OPERATOR**
- **METHODS FOR FUSING MULTI-SENSOR INFORMATION**
- **ANALYTIC TECHNIQUES FOR SYNTHESIZING ALGORITHMS**
- **DEVELOPMENT OF TEST METHODOLOGIES FOR EVALUATING ATRs.**





# ARMY WEAPON PLATFORM ATR INSERTION CANDIDATES

PLATFORM	MISSION	CURRENT SENSORS	PROJECTED FUNCTIONS
AH-64	ATTACK HELICOPTER	TADSIPNVS (DAY TV, DVO, LRF/D LST, FLIRS)	MMW RADAR
AHIP	SCOUT HELICOPTER	MMS (FLIR, DAY TV, LST, LRF/D)	-
AQUILA	RPV	DAY TV	SCANNED MINI FLIR FPA-BASED FLIR
M1	MAIN BATTLE TANK	DVO, TIS	MMW RADAR
M2/M3	INFANTRY FIGHTING VEHICLE	DVO, LOW-LIGHT-LEVEL TV	ELEVATED TARGET ACQUISITION SYSTEM
HELLFIRE	FIRE AND FORGET MISSILE SEEKER	SEMI-ACTIVE LASER SEEKER	FIRE AND FORGET IMAGING IR SEEKER
CORPS SUPPORT WEAPON SYSTEM	TERMINALLY GUIDED SUBMUNITION	-	IMAGING IR SEEKER
LHX	SINGLE SEAT ATTACK HELICOPTER	-	FLIR, DAY, TV, MMW RADAR, FPA-BASED THREAT WARNING





# **COMBAT VEHICLE COMMAND & CONTROL (CVC2)**



## **OVERALL OBJECTIVES**

- TO DEVELOP AND DEMONSTRATE TECHNOLOGIES FOR AUTOMATING THE 'COCKPIT' OF GROUND COMBAT VEHICLES AND FOR PROVIDING THE NETWORKING OF VEHICLES AT THE INDIVIDUAL VEHICLE, PLATOON, COMPANY AND BATTALION COMMANDER ECHELONS FOR PERFORMING EMBEDDED COMMAND AND CONTROL FOR THE GROUND COMBAT MANEUVER FORCE
- INTEROPERABILITY WITHIN THE U.S. ARMY AND AMONG NATO ALLIES

**RESPONSIBLE AGENCIES: USATACOM**

**PRINCIPAL POC: MR. DONALD S. SARNA  
USA TACOM  
(313) 574-6160**





# COMBAT VEHICLE COMMAND & CONTROL (CVC2)



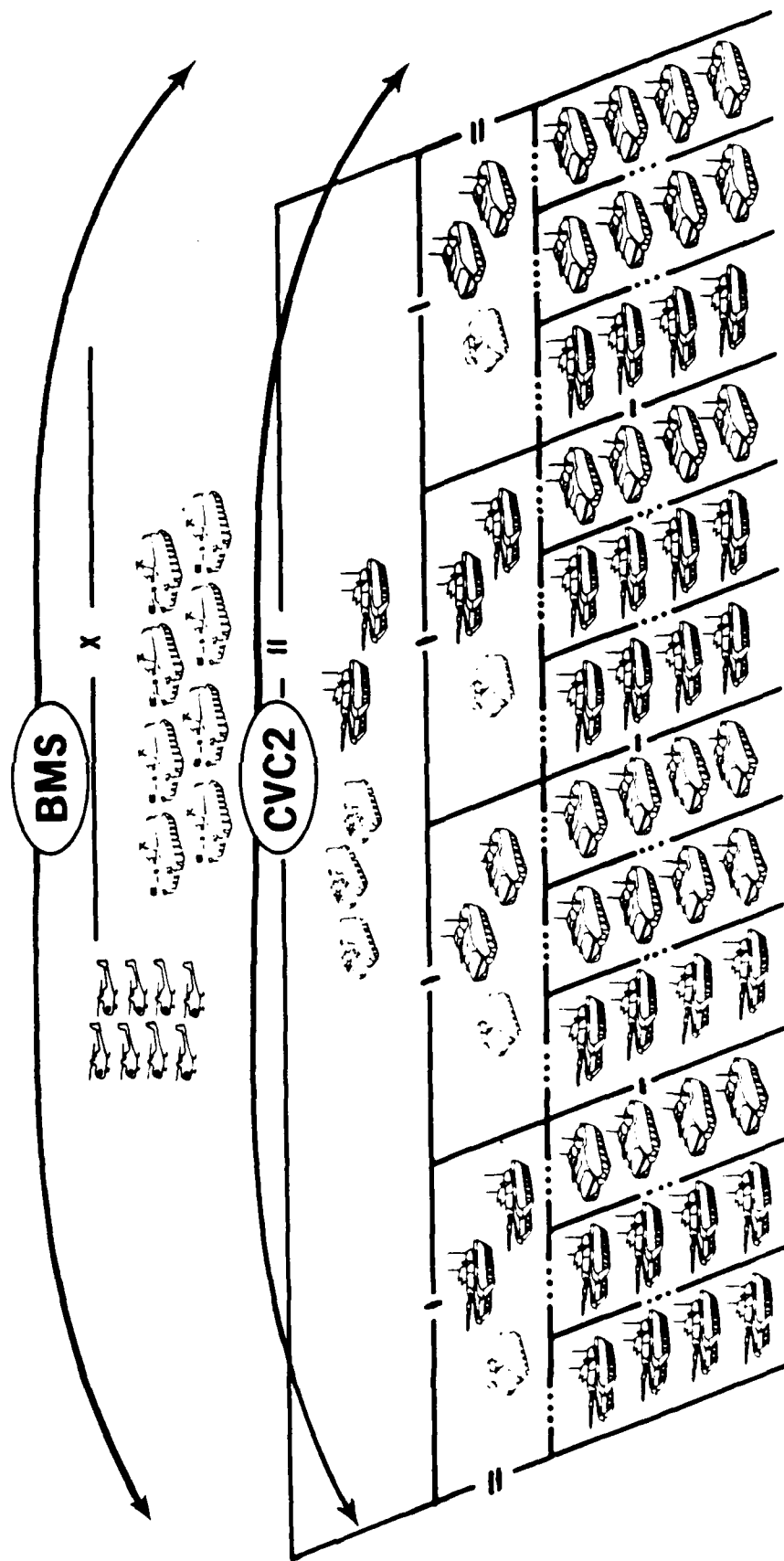
## BACKGROUND

- FUTURE BATTLEFIELD MANEUVER FORCE CHARACTERISTICS
  - SMALL SELF-SUFFICIENT ORGANIZATIONS
  - HIGHLY MOBILE
  - FIREPOWER INTENSIVE
  - EXTREMELY AGILE DISPERSION/MASS CAPABILITY
  - HIGHLY COORDINATED/SYNCHRONIZED
- COORDINATION/SYNCHRONIZATION AT BRIGADE AND HIGHER ECHELONS BY AUTOMATED C3I SYSTEMS BEING DEVELOPED UNDER THE ARMY COMMAND AND CONTROL SYSTEM (ACCS)
- DEFICIENT AT BATTALION AND BELOW ECHELONS WHICH REPRESENT THE CUTTING EDGE OF THE MANEUVER FORCE
  - CURRENT PRACTICE
  - VOICE RADIO
  - PAPER MAPS
  - PLASTIC OVERLAYS/GREASE PENCILS





# COMBAT VEHICLE COMMAND & CONTROL (CVC2)

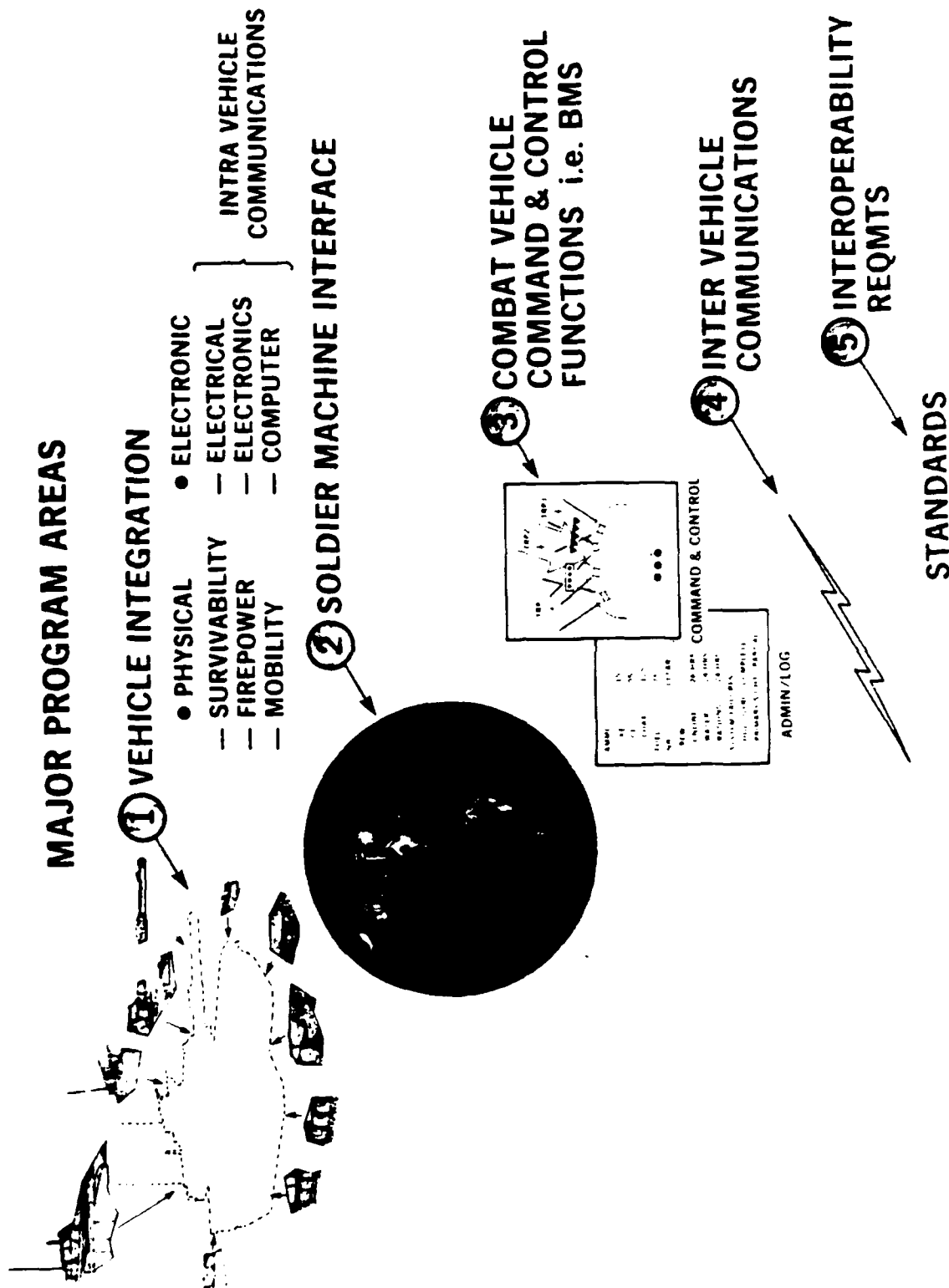


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# COMBAT VEHICLE COMMAND & CONTROL (CVC2)







# **COMBAT VEHICLE COMMAND & CONTROL (CVC2)**



## **TARGETS OF OPPORTUNITY**

- CVC2 INTEGRATION INTO MIAI BLOCK II ABRAMS TANK
- CVC2 INTEGRATION INTO THE STANDARD ARMY VETRONICS ARCHITECTURE (SAVA) FOR APPLICATION TO FUTURE COMBAT VEHICLES AND PRODUCT IMPROVEMENTS
- OPTIMIZATION OF SOLDIER MACHINE INTERFACE FOR FUTURE AND PRODUCT IMPROVED COMBAT VEHICLES
- STANDARDIZATION TO ACHIEVE CVC2 INTEROPERABILITY WITH NATO ALLIES





# LIQUID PROPELLANT GUN



## OVERALL OBJECTIVES

- DESIGN, FABRICATE, AND TEST FULL SCALE, HIGH PERFORMANCE LIQUID PROPELLANT GUNS FOR ANTI-ARMOR APPLICATIONS
- CONDUCT NECESSARY STUDIES, EVALUATIONS, AND PREPARATIONS TO SUPPORT FUTURE DEVELOPMENT AND FIELDING CONSISTENT WITH ANTI-ARMOR MODERNIZATION PLANS

## RESPONSIBLE AGENCIES: BRL

ARDEC

PRINCIPAL POC: DR. W.F. MORRISON  
BRL  
(301-278-6188)





# LIQUID PROPELLANT GUN



## PROGRAM RATIONALE AND SYSTEM ADVANTAGES

- THREAT ARMORS INCREASINGLY DIFFICULT TO DEFEAT
- LARGER CANNONS DELIVERING MORE KINETIC ENERGY PROVIDES DIRECT APPROACH
- SOLID PROPELLANT APPROACHES FEASIBLE;
  - AUTOMATION MORE DIFFICULT
  - AMMUNITION STOWAGE REDUCED DUE TO LARGE CHARGES REQUIRED
- ADVANTAGES OFFERED BY AN LP APPROACH
  - REQUIRED PERFORMANCE CAN BE OBTAINED
  - INCREASED AMMO STOWAGE DUE TO HIGH PACKING EFFICIENCY
  - AUTOMATION IS SIMPLIFIED SINCE ONLY THE PROJECTILE IS MECHANICALLY HANDLED
  - LP PUMPED TO THE CANNON FROM ON-BOARD LOCATION REMOTE FROM THE CREW, ENHANCING SURVIVABILITY (LOW LP SENSITIVITY)
  - PROTECTED VOLUME CAN BE REDUCED, REDUCING SYSTEM WEIGHT AND PROFILE





# LIQUID PROPELLANT GUN



## PROGRAM APPROACH

- BUILD ON ARTILLERY LP PROGRAM TECHNOLOGY
- 6-MONTH SYSTEM STUDIES (SEP 87)
- 120mm HARDWARE COMPONENT DEVELOPMENT (3Q FY88)
  - LARGER CALIBER AS REQUIRED (FY90)
- RD&E CENTER INVOLVEMENT THROUGHOUT THE PROGRAM

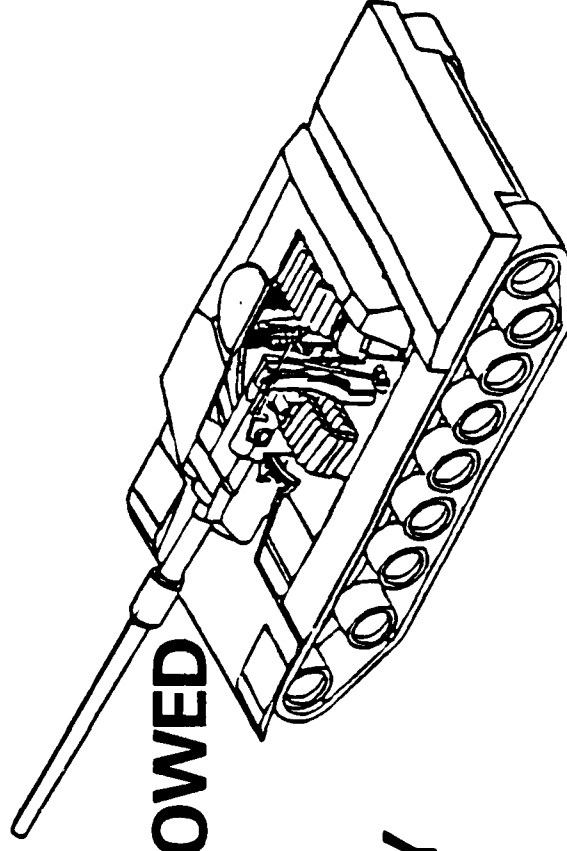




# LIQUID PROPELLANT GUN



- FST3+ CAPABILITY
- HIGH RATE OF FIRE
- 50% INCREASED STOWED LOAD
- LOW VULNERABILITY LIQUID PROPELLANT



**MORE COMBAT-EFFECTIVE TANK**





# **LIQUID PROPELLANT GUN**



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## **PROBLEMS OF INTEREST**

- **INNOVATIVE GUN PROPULSION CONCEPTS USING LP**
- **HIGH ENERGY, LOW VULNERABILITY LIQUID PROPELLANTS**
- **HIGH PRESSURE SEALS TECHNOLOGY FOR LP GUNS**
- **INVESTIGATION AND ANALYSIS OF HIGH PRESSURE COMBUSTION PROCESSES IN LP GUNS**
- **ANALYSIS OF COMPATIBILITY OF MATERIALS FOR USE IN LP GUNS**





# **COILGUN TECHNOLOGY DEVELOPMENT**

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## **OVERALL OBJECTIVES**

- DEMONSTRATE THE MATURITY OF COILGUN TECHNOLOGY FOR TACTICAL APPLICATION
- PROVIDE LEAP AHEAD PERFORMANCE FOR TACTICAL WEAPONS

## **RESPONSIBLE AGENCY:**

- ARMY

## **PRINCIPAL POC:**

- DR. TED GORA  
ARDEC  
(201) 724-4670





# COILGUN TECHNOLOGY DEVELOPMENT



## TACTICAL OBJECTIVES

INCREASE VELOCITY

ELIMINATE PROPELLANTS

LONGER RANGE

REDUCE LOGISTIC BURDEN

FASTER FLIGHT TIME

IMPROVE SURVIVABILITY

IMPROVED PENETRATION

EASE OF AUTOMATION

REDUCE PEAK G-LOAD ON  
PROJECTILE

REDUCE RECOIL

CONTINUOUS ZONING

FIELD HIGHLY RELIABLE WEAPON SYSTEMS  
WITH LEAP AHEAD PERFORMANCE





# **COILGUN TECHNOLOGY DEVELOPMENT**



## **MAJOR PROGRAM ELEMENTS**

- 9 MJ SKID MOUNTED COILGUN (120mm GUN EQUIVALENT) FOR FY90 DEMO
- 15 MJ VEHICLE MOUNTED COILGUN FOR FY92 DEMO
- ACCELERATOR AND PULSE POWER TECHNOLOGY TO SUPPORT THE 9 & 15 MJ DEMONSTRATIONS
- ANALYSIS OF UTILITY OF COILGUNS FOR ARMOR, AIR DEFENSE, ARTILLERY AND TACTICAL MISSILE DEFENSE



# PROGRAM SCOPE

---

## PHASE I MULTI SHOT 9 MJ(120mm EQUIVALENT) DEMO STARTING FY90

3 ROUNDS PER MINUTE

11.5 TON WEIGHT, MOVEABLE, INCL AUTOLOADER, FUEL, AMMO

SELF CONTAINED, NO UMBILICALS

2500-4000 METERS/SECOND

LAUNCH WEIGHTS OF 1-2.5 KG

## CONCURRENT TECH BASE EFFORTS

## PHASE II MOBILE, MULTI-SHOT 15 MJ(135mm EQUIVALENT) EM GUN DEMO STARTING FY92

AFV P3I CANDIDATE

5 ROUNDS PER MINUTE

7-12 TONS-WEAPON MODULE, 55 TON CLASS VEHICLE

LAUNCH WEIGHTS 2-5KG AT 2500-4000 METERS/SECOND

FIRE CONTROL, UNGUIDED AND GUIDED PROJECTILES

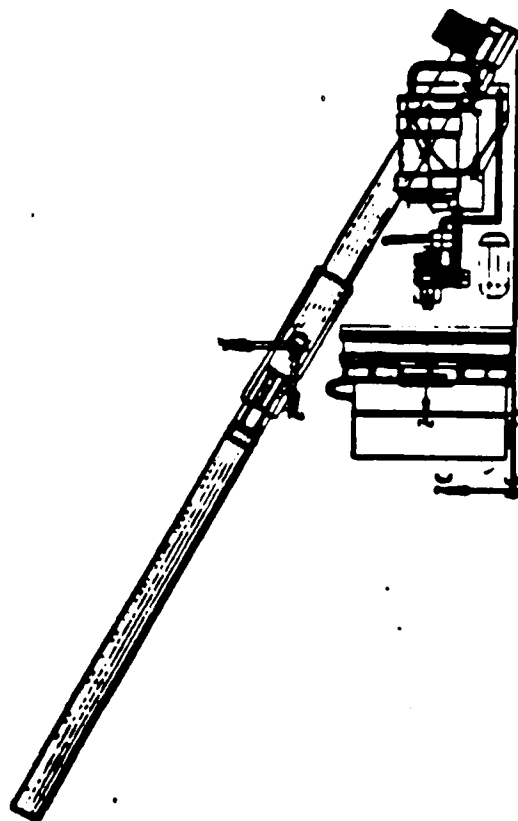
.25 MIL DISPERSION



# 9MJ COILGUN SYSTEM

## OBJECTIVE

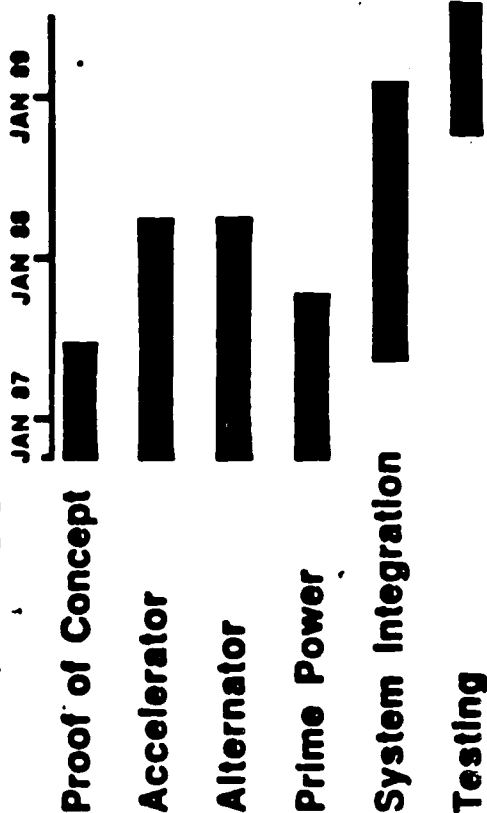
BY 22 MAY 1989, FOR LESS THAN \$8.5M,  
DEVELOP AND TEST A SLED-MOUNTED,  
COILGUN SYSTEM THAT FIRES 9MJ  
PROJECTILE PACKAGES EVERY 20 SEC  
FOR 3 MINUTES



## CHARACTERISTICS

- LIGHTWEIGHT SYSTEM  
(11,000 KG)
- MINIMUM BARREL EROSION  
(200 Kamp current)
- HIGH EFFICIENCY  
(50% Turbine-muzzle)
- FIRES HIGH ASPECT RATIO  
PENETRATORS  
(L/D>30)

## SCHEDULE







# **COMMAND AJUSTED TRAJECTORY FIRE CONTROL SYSTEM (CAT/FCS)**

**(COMMAND GUIDED MULTI PURPOSE PROJECTILE)**



## **OVERALL OBJECTIVES:**

- DEVELOP TECHNOLOGY FOR A COST EFFECTIVE COMMAND GUIDED ANTI ARMOR/ANTI HELICOPTER TANK LAUNCHED PROJECTILE
- LIVE FIRE DEMONSTRATE IMPROVEMENTS IN SYSTEM ACCURACY OF A COMMAND GUIDED PROJECTILE & ITS COMPATABILITY WITH GUN/WEAPON PLATFORM (TECHNOLOGY DEMONSTRATION)
- INCORPORATE COMMAND GUIDANCE TECHNOLOGY WITH IMPROVED PROJECTILE LETHALITY/FUZING MECHANISMS TO DEMONSTRATE BEST OPERATIONAL SYSTEM APPROACH TO DEFEATING TARGETS

## **RESPONSIBLE AGENCY:**

- US ARMY, ARDEC

## **PRINCIPAL POC:**

- MR. MODESTO BARBARISI  
ARDEC  
(201) 724-6264





# ***Command Adjusted Trajectory Fire Control System (CAT/FCS)***

***(COMMAND GUIDED MULTI PURPOSE PROJECTILE)***

---

## **PROGRAM DESCRIPTION:**

TO DEVELOP & DEMONSTRATE A LOW COST SMART WEAPON/PROJECTILE  
CONCEPT TO GREATLY IMPROVE TANKS PH AT LONG RANGES & GIVE THE  
TANK A SELF DEFENSE CAPABILITY AGAINST MOVING AIRBORNE THREATS

## **TECHNICAL APPROACH:**

- MANEUVERABLE PROJECTILE
- DATA LINK
- SMART FIRE CONTROL SYSTEM (TRACKS TARGET & PROJECTILE)





# ***Command Adjusted Trajectory Fire Control System (CAT/FCS)***

***(COMMAND GUIDED MULTI PURPOSE PROJECTILE)***

---

## **BACKGROUND:**

ARDEC SPONSORED TECH BASE PROGRAM 1983 - 1986. DEMONSTRATED  
THRU LIVE FIRE THE FOLLOWING KEY TECHNICAL ISSUES. (40MM DEMO)

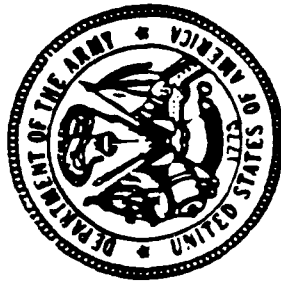
## **PROJECTILE:**

- CAN RECEIVE & EXECUTE COURSE CORRECTIONS
- STABILITY THRU IMPULSE THRUSTER COURSE CORRECTIONS
- COMPONENTS SURVIVE 45,000G GUN LAUNCH

## **FIRE CONTROL:**

- REAL TIME PROJECTILE TRACKING
- REAL TIME COMPUTATION OF COURSE CORRECTIONS
- COMMAND MANEUVERS





# ***Command Adjusted Trajectory Fire Control System (CAT/FCS)***

***(COMMAND GUIDED MULTI PURPOSE PROJECTILE)***

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## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- DESIGN STUDIES, SIMULATIONS AND ANALYSIS
- REQUIREMENTS AND EFFECTIVENESS ANALYSIS
- COMPONENT DEVELOPMENT TESTING & SURVIVABILITY
- MANEUVERING PROJECTILE AERODYNAMIC EVALUATION AND TESTING
- LAB & FIELD TEST OF FIRE CONTROL/PROJECTILE COMPONENTS & SUB SYSTEMS
- LIVE FIRE SYSTEM TESTING TO SHOW IMPROVED ACCURACY & OPERATIONAL EFFECTIVENESS





# ***Command Adjusted Trajectory Fire Control System (CAT/FCS)***

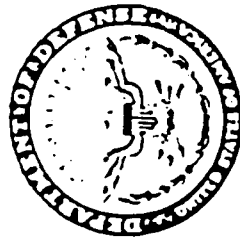
***(COMMAND GUIDED MULTI PURPOSE PROJECTILE)***

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## ***REPRESENTATIVE PROBLEMS OF INTEREST TO DOD***

- **REAL TIME PROJECTILE/TARGET TRACKING**
- **GUIDANCE ALGORITHMS/TECHNIQUES FOR MOST EFFECTIVE USE OF PROJECTILE CONTROL ENERGY**
- **ELECTRO-MAGNETIC DATA LINK BETWEEN GUN PLATFORM AND PROJECTILE AND ITS RELIABILITY IN ATMOSPHERIC/BATTLEFIELD/COUNTER MEASURES ENVIRONMENT**
- **PROJECTILE CONTROL TECHNIQUES**
- **PROJECTILE LETHALITY/FUZING TECHNIQUES TO SERVE IN A MULTI-TARGET MODE (GROUND/AIR)**





# GROUND LAUNCHED HELLFIRE

## OVERALL OBJECTIVE

- TO SATISFY THE IMMEDIATE NEED OF THE 9TH INFANTRY DIVISION WITH A LONG RANGE, LETHAL, HIGHLY MOBILE ANTI-ARMOR CAPABILITY BY INCORPORATING THE HELLFIRE MISSILE SYSTEM ON A HMMWV
- TO EVALUATE THE FEASIBILITY OF PROVIDING OTHER LIGHT FORCES THE SAME ANTI-ARMOR CAPABILITY AS THE 9TH ID

## RESPONSIBLE AGENCY:

U.S. ARMY MISSILE COMMAND (MICOM)  
HELLFIRE PROGRAM OFFICE

## PRINCIPLE POC:

MAJ TERRY WHITTINGTON  
MICOM

(205) 876-8652/9771<sup>68</sup>





## GROUND LAUNCHED HELLFIRE



### MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM

- MAXIMUM USE OF NONDEVELOPMENTAL ITEMS (NDI)
- MAXIMUM USE OF HELLFIRE PRODUCTION COMPONENTS
- MINIMIZE PROGRAM RISK BY USE OF TECHNOLOGY WELL WITHIN CURRENT STATE OF THE ART





# GROUND LAUNCHED HELLFIRE



## REPRESENTATIVE OPERATIONAL ISSUES OF INTEREST TO DOD

- o ANALYSIS OF LONG RANGE, LETHAL, MOBILE, ANTI-ARMOR  
SYSTEM IN LIGHT FORCES





# HIGH POWER MICROWAVES (HPM)

## OVERALL OBJECTIVES

- TO BETTER UNDERSTAND THE EFFECTS OF AN HPM DIRECTED ENERGY WEAPON ON ARMY MATERIEL
- TO DEVELOP NEW TECHNOLOGY TO HARDEN ARMY MATERIEL AGAINST THE HPM THREAT
- TO DEVELOP NEW HPM COMPONENTS FOR HPM SIMULATION AND POSSIBLE SYSTEM APPLICATION

THIS IS A JOINT PROGRAM MANAGED BY THE PROGRAM IMPLEMENTATION PANEL OF THE OSD HPM EXECUTIVE STEERING GROUP

PRINCIPLE ARMY POC: DR. EDWARD A. BROWN  
HARRY DIAMOND LABORATORIES  
US ARMY LABORATORY COMMAND  
(202) 394-4664





# HIGH POWER MICROWAVES (HPM)



## STRUCTURE OF THE NATIONAL BTI HPM PROGRAM

	<u>ARMY</u>	<u>NAVY</u>	<u>AIR FORCE</u>	<u>DNA</u>
EFFECTS TESTING	X	X	X	X
HARDENING	X	X		
COMPONENTS	X	X	X	X
PROPAGATION/PHENOMENOLOGY				X
METHODOLOGY				X





# HIGH POWER MICROWAVES (HPM)



## ARMY BTI PROGRAM IN HPM

### EFFECTS TESTING:

EFFECTS ON MUNITIONS, FUELS, ENERGETIC MATERIALS  
UPGRADE OF TESTING CAPABILITY  
EFFECTS TESTING ON FOREIGN SYSTEMS  
INVESTIGATIONS OF BIO-EFFECTS

### HARDENING TECHNOLOGY:

HARDENING PRACTICES  
HARDENING REQUIREMENTS  
COUPLING AND BOUNDARY VALUE CALCULATIONS  
SCENARIO ENGAGEMENT MODEL  
RF SHIELDING COATINGS

### COMPONENTS DEVELOPMENT:

HIGH EFFICIENCY PHASE LOCKED SOURCES  
ANTENNA TECHNOLOGY  
MODE CONVERSION  
SOLID STATE SOURCES





# TACTICAL MISSILE INTERCEPTOR TECHNOLOGY



## OVERALL OBJECTIVES

- TO DEVELOP TECHNOLOGY FOR TERMINAL PHASE INTERCEPTION OF TACTICAL MISSILES
- TO DEVELOP ADVANCED TECHNOLOGY FOR GUIDANCE AND CONTROL SYSTEM, ASSOCIATED WARHEAD, AND FUZE

## RESPONSIBLE AGENCIES:

HIMAD PEO

JTMD PROJECT OFFICE

## PRINCIPAL POC:

MR. ROGER COMER

(205) 895-4384

HIMAD PEO

REDSTONE ARSENAL, AL 35898





# TACTICAL MISSILE INTERCEPTOR TECHNOLOGY



## MAJOR ELEMENTS OF A COMPREHENSIVE TACTICAL MISSILE INTERCEPTOR PROGRAM

- STUDIES AND ANALYSES OF US AND FOREIGN SEEKER TECHNOLOGY
- DEVELOPMENT AND DEMONSTRATION OF BRASSBOARD AND SIMULATION MODELS
- EXAMINE US & FOREIGN SYSTEM INTEROPERABILITY REQUIREMENT
- DEVELOPMENT AND DEMONSTRATION OF TACTICAL MISSILE TECHNOLOGY IN LIVE FIRE TESTING
- EXPERIMENTAL DEMONSTRATION / VALIDATION OF ADVANCED GUIDANCE SEEKER TECHNOLOGY
- EXPERIMENTAL DEMONSTRATION / VALIDATION OF ADVANCED FUZING TECHNOLOGY
- EXPERIMENTAL DEMONSTRATION / VALIDATION OF ADVANCED KINETIC-KILL WARHEAD TECHNOLOGY





# TACTICAL MISSILE INTERCEPTOR TECHNOLOGY



## REPRESENTATIVE TECHNOLOGY OF INTEREST

- ANALYSES OF TACTICAL MISSILE INTERCEPTOR TECHNOLOGY
- DESIGN AND EVALUATION OF GUIDANCE SEEKER TECHNOLOGY
- DESIGN AND EVALUATION OF WARHEAD FUZING TECHNOLOGY
- DESIGN AND EVALUATION OF KINETIC-KILL WARHEAD TECHNOLOGY
- ANALYSIS OF FOREIGN TECHNOLOGY APPLICABLE TO TACTICAL MISSILE INTERCEPTION



# NAVY BTI PROJECTS



## **NAVY BALANCED TECHNOLOGY INITIATIVE PROJECTS**

Navy participation in the BTI Program for FY 1987 involves work on 9 projects funded at a total of \$45.8 million. Specific projects include the following:

HIGH PERFORMANCE INFRARED SEEKER  
SUBMARINE ANTI-TORPEDO WEAPON  
UNDERSEA SURVEILLANCE  
TARGET ACQUISITION FOR SHIP DEFENSE  
FIBER OPTICAL DATA LINK FOR AIR LAUNCHED WEAPONS  
FOLLOW THROUGH TORPEDO WARHEAD  
AMPHIBIOUS ASSAULT COUNTERMINE SYSTEM  
HIGH POWER MICROWAVES  
HIGH ENERGY LASER FOR SHIP DEFENSE

Details regarding these projects are provided in the following charts.





# **HIGH PERFORMANCE INFRARED (IR) SEEKER**



## **OVERALL OBJECTIVE:**

- **DEVELOP AN INFRARED (IR) SEEKER FOR  
HYPERVELOCITY MISSILES**

**RESPONSIBLE AGENCY: NAVY**

**PRINCIPAL POC: CAPT McDOUGAL  
NAVY NAVSEA 62Z3  
(202) 692-0662**





# **HIGH PERFORMANCE INFRARED (IR) SEEKER**



## **REPRESENTATIVE IR SEEKER PROBLEMS OF INTEREST TO DOD**

- **DESIGN A RF/IR WINDOW WHICH ALLOWS THE  
IR SEEKER TO OPERATE IN LOCAL HIGH  
TEMPERATURE ENVIRONMENTS**
- **MULTI-SPECTRAL SENSOR INTEGRATION**
- **CLUTTER REJECTION TECHNIQUES**
- **ECCM**





# **HIGH PERFORMANCE INFRARED (IR) SEEKER**



## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **WIND TUNNEL TESTS OF ALTERNATIVE WINDOW MATERIALS**
- **DEVELOP METHODS TO ATTACH IR DOME TO EXISTING RADOME**
- **INVESTIGATIONS OF ALTERNATIVE DOME COOLING METHODS**
- **SOLICIT DESIGN APPROACHES FROM THREE INDUSTRY SOURCES**
- **DEVELOP AND TEST TWO PREFERRED DESIGN APPROACHES AGAINST ADVANCED TARGETS**
- **DOCUMENTATION PACKAGE FOR FULL SCALE ENGINEERING DEVELOPMENT**





# **SUBMARINE ANTI-TORPEDO WEAPON**



## **OVERALL OBJECTIVES:**

- **DEVELOP AND DEMONSTRATE AN ADVANCED  
HARD KILL ANTI-TORPEDO WEAPON CONCEPT  
COMPATIBLE WITH EXISTING ATTACK SUBMARINE  
COUNTERMEASURE LAUNCHING SYSTEMS**
- **DEVELOP THE TECHNICAL BASE FOR PRODUCING  
THE NEXT GENERATION TORPEDO HARD KILL  
SYSTEM CONCEPTS**

**RESPONSIBLE AGENCIES: NAVY  
DARPA**

**PRINCIPAL POC: CAPT ED GRAHAM  
NAVY NAVSEA 63B  
(202) 692-8530**





# **SUBMARINE ANTI-TORPEDO WEAPON**



## **REPRESENTATIVE ANTI-TORPEDO WEAPON PROBLEMS OF INTEREST TO DOD**

- **DEFINITION OF TARGET SIGNATURES**
- **DETECTION METHODS OF THE INCOMING TORPEDO**
- **SELECTION OF GUIDANCE AND CONTROL, PROPULSION  
AND WARHEAD SUBSYSTEMS**
- **DEFINITION OF SUBMARINE LAUNCHER EFFECTS ON  
THE WEAPON**
- **LOCALIZATION ACCURACY REQUIRED**
- **EFFECTIVENESS OF WEAPON IN MULTIPLE TARGET AND  
COUNTERMEASURE ENVIRONMENTS**





# **SUBMARINE ANTI-TORPEDO WEAPON**



## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **RAPID PROTOTYPE (NAVY)**
  - **TARGET STRENGTH TESTS**
  - **DEVELOPMENT OF FIRE CONTROL SOLUTIONS**
  - **GUIDANCE AND CONTROL DESIGN**
  - **PROTOTYPE FABRICATION**
  - **IN-WATER TEST AND EVALUATION**
  - **DOCUMENTATION PACKAGE FOR FULL SCALE ENGINEERING DEVELOPMENT**
- **TECHNICAL BASE (DARPA)**
  - **INDUSTRY INVESTIGATIONS OF CRITICAL SUBSYSTEM TECHNOLOGIES AND NEW SYSTEM DESIGN APPROACHES**





# UNDERSEA SURVEILLANCE



## OVERALL OBJECTIVE:

- SUPPLEMENT ONGOING UNDERSEA SURVEILLANCE RESEARCH TO HELP MAINTAIN A DEVELOPMENT PACE THAT IS TECHNOLOGY LIMITED IN THE AREAS OF PASSIVE AND ACTIVE ACOUSTICS

RESPONSIBLE AGENCY: NAVY

PRINCIPAL POC: RADM DORMAN  
NAVY SPAWAR PD-80  
(202) 697-4737





# UNDERSEA SURVEILLANCE

## REPRESENTATIVE UNDERSEA SURVEILLANCE PROBLEMS OF INTEREST TO DOD

- **GENERIC**
  - DETECTION, LOCALIZATION, CLASSIFICATION, AND TRACKING OF QUIET SOVIET SUBMARINES AT LONG RANGES, SLOW SPEEDS, AND VARIOUS AT-SEA ENVIRONMENTS
  - MINIMIZING TIME LATE IN DETECTION REPORTING
  - REDUCING FALSE ALARMS
  - ENSURING SURVEILLANCE SYSTEMS' SURVIVABILITY IN HEIGHTENED STAGES OF HOSTILITY
  - FULLY EXPLOITING EMERGING TECHNOLOGIES IN COMPUTERS, ARTIFICIAL INTELLIGENCE, FIBER OPTICS, POWER SOURCES, OCEAN ENGINEERING, SENSORS, ETC.
  - MAINTAINING A BALANCE BETWEEN PLATFORMS, SYSTEMS, AND AFFORDABILITY
  - DEVELOPING COMPETITIVE STRATEGIES
- **SPECIFIC**
  - PUSH PASSIVE ACOUSTICS TO ITS THEORETICAL LIMITS
  - DEVELOP A TECHNICAL BASE TO AUGMENT PASSIVE ACOUSTICS WITH ACTIVE ACOUSTICS





# UNDERSEA SURVEILLANCE



## MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM

- PASSIVE ACOUSTICS
  - ANALYSIS OF AT-SEA TEST DATA TO EXPLOIT NON-TRADITIONAL SUBMARINE CHARACTERISTICS
  - DEVELOP AND TEST WIDER APERTURE ARRAYS, ARRAY GEOMETRIES, AND ARRAY SENSORS
  - ANALYZE ARRAY DATA LINKS AND DEVELOP MORE ROBUST APPROACHES
- ACTIVE ACOUSTICS
  - IDENTIFY AND EVALUATE PROMISING SOURCE TECHNOLOGIES
  - DEVELOP AND VALIDATE TRANSMISSION / REVERBERATION PATH MODELS
  - FORMULATE C2 METHODS FOR BOTH STRATEGIC AND TACTICAL APPLICATIONS
  - INCREASE THE CAPABILITY OF EXISTING SENSOR SYSTEMS TO BETTER COLLECT ACTIVE SIGNALS OF INTEREST
  - DEVELOP AND INSTALL AN OPEN OCEAN ACTIVE TEST RANGE





# TARGET ACQUISITION FOR SHIP DEFENSE



## OVERALL OBJECTIVE:

- INVESTIGATE THE PERFORMANCE POTENTIAL OF A DUAL-BAND MILLIMETER WAVE RADAR SENSOR FOR SHORT RANGE ANTI-AIR WARFARE SELF DEFENSE OF SURFACE SHIPS AGAINST THE POSTULATED ANTI-SHIP MISSILE THREAT

RESPONSIBLE AGENCY: NAVY

PRINCIPAL POC: CAPT SOVEY  
NAVY NAVSEA 62D  
(202) 692-0648





# TARGET ACQUISITION FOR SHIP DEFENSE



## REPRESENTATIVE TARGET ACQUISITION PROBLEMS OF INTEREST TO DOD

- SENSOR PERFORMANCE AGAINST LOW OBSERVABLE, VARIABLE SPEED, HIGHLY MANEUVERING TARGETS IN AN AT-SEA HIGH ECM ENVIRONMENT
- MULTI-SPECTRAL SENSOR FUSION
- FIRE CONTROL/WEAPONS INTEGRATION
- SENSOR CUEING
- SHIPBOARD INTEGRATION
- SENSOR PERFORMANCE AGAINST VARYING THREAT DENSITIES AND AXES





# TARGET ACQUISITION FOR SHIP DEFENSE



## MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM

- DOCUMENT BASELINE SYSTEM PERFORMANCE AGAINST ADVANCED FUTURE THREATS
- OBTAIN AND UPGRADE SEVERAL EXISTING MM RADARS FOR USE IN AN AT-SEA SELF DEFENSE ROLE
- DEMONSTRATE MM WAVE RADAR PERFORMANCE USING LOW OBSERVABLE TARGETS IN AN AT-SEA ENVIRONMENT
- ANALYZE PAYOFF FROM INTEGRATING MM RADAR INTO PLANNED SENSOR SYSTEMS
- ANALYZE PAYOFF FROM ADDING BOTH A MM WAVE RADAR AND THE HYPERVELOCITY MISSILE TO THE PLANNED SELF DEFENSE SYSTEM
- DOCUMENTATION PACKAGE FOR FULL SCALE ENGINEERING DEVELOPMENT



NO-A187 875 BALANCED TECHNOLOGY INITIATIVE BRIEFING TO INDUSTRY(U)  
OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE

2/2

BALANCED TECHNOLOGY INITIATIVE BRIEFING TO INDUSTRY(U)  
OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE  
(RESEARCH AND ADVANCED TECHNOLOGY WASHINGTON DC

**UNCLASSIFIED**

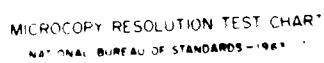
26 AUG 87

F/8 15/3

NL

Figure 1 displays a 10x10 grid of 100 small images, each showing a handwritten digit '4' on a black background. The images are arranged in a grid, with the digit '4' appearing to be drawn or revealed from left to right and top to bottom. The images are labeled with numbers 1 through 100, indicating a sequence of frames or steps in the digit's formation.





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A





# FIBER OPTIC DATA LINK FOR AIR LAUNCHED WEAPONS



## OVERALL OBJECTIVE:

- DEMONSTRATE THE TECHNICAL FEASIBILITY AND OPERATION POTENTIAL OF A HIGH PERFORMANCE, FIBER OPTIC, COMMAND AND CONTROL DATA LINK SUITABLE FOR USE WITH EXISTING AND FUTURE NAVY AND AIR FORCE PRECISION GUIDED AIR-LAUNCHED WEAPONS

RESPONSIBLE AGENCIES: NAVY  
USAF  
ARMY

PRINCIPAL POC: CAPT CHALKLEY  
NAVY NAVAIR 93  
(202) 692-7439





# FIBER OPTIC DATA LINK FOR AIR LAUNCHED WEAPONS



## REPRESENTATIVE FIBER OPTIC DATA LINK PROBLEMS OF INTEREST TO DOD

- AERODYNAMIC PROPERTIES OF HIGH SPEED PAYOUT FIBER OPTIC DATA LINKS FROM POWERED AND UNPOWERED AIR LAUNCHED WEAPONS
- DEVELOPMENT OF COMPACT FIBER OPTIC BOBBINS AND MANUFACTURING METHODS FOR LOW PACKAGING OVERHEAD AND LONG RANGE
- RELIABILITY AND MAINTAINABILITY OF LONG LENGTH FIBERS STORED ON A BOBBIN IN VARIOUS ENVIRONMENTS
- SENSOR AND PROCESSING BENEFITS FROM THE USE OF FIBER OPTIC DATA LINKS





# **FIBER OPTIC DATA LINK FOR AIR LAUNCHED WEAPONS**



## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **FIBER/SPOOL DEMONSTRATION IN TACTICAL ENVIRONMENTS  
USING GLIDE WEAPONS**
- **SHORT RANGE, ADVANCED FIBER/SPOOL DEMONSTRATION  
USING GLIDE WEAPONS**
- **SHORT RANGE, ADVANCED FIBER/SPOOL DEMONSTRATION  
USING POWERED WEAPONS**
- **LONG RANGE, ADVANCED FIBER/SPOOL DEMONSTRATION  
USING GLIDE WEAPONS**
- **LONG RANGE, ADVANCED FIBER/SPOOL DEMONSTRATION  
USING POWERED WEAPONS**
- **CONTINUALLY EVALUATE TRANSITION POTENTIAL AND DEVELOP  
ENGINEERING DEVELOPMENT PACKAGES AS REQUIRED**





# **FOLLOW THROUGH TORPEDO WARHEAD**

## **OVERALL OBJECTIVE:**

- **DEVELOP AND DEMONSTRATE A MORE LETHAL  
WARHEAD FOR THE MK-50 TORPEDO TO REPLACE  
THE SHAPED CHARGE CURRENTLY USED**

**RESPONSIBLE AGENCY: NAVY**

**PRINCIPAL POC: CAPT ED GRAHAM  
NAVY NAVSEA 63B  
(202) 692-8530**





# **FOLLOW THROUGH TORPEDO WARHEAD**

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## **REPRESENTATIVE TORPEDO WARHEAD PROBLEMS OF INTEREST TO DOD**

- **WARHEAD LETHALITY**
  - **KNOWN THREAT TARGETS**
  - **ENSURING EFFECTIVENESS AGAINST  
FUTURE THREAT TARGET CHANGES**
- **WEIGHT AND SIZE RESTRICTIONS OF  
THE MK-50**





# **FOLLOW THROUGH TORPEDO WARHEAD**



## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **CONTINUATION AND EXPANSION OF ONGOING LIGHTWEIGHT GUN BARREL APPROACH FOR FIRING EXPLOSIVE CHARGE**
- **DEVELOPMENT OF FUZING DESIGN CONCEPT**
- **EVALUATION OF NOSE BREAKER DESIGNS**
- **DEVELOPMENT OF LETHALITY ENHANCING DEVICES**
- **DESIGN AND FABRICATE PROTOTYPE SYSTEM**
- **CONDUCT AT-SEA TESTS OF PROTOTYPE SYSTEM**
- **DOCUMENTATION PACKAGE FOR FULL-SCALE ENGINEERING DEVELOPMENT**





# **AMPHIBIOUS ASSAULT COUNTERMINE SYSTEM**

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## **OVERALL OBJECTIVE:**

- **ACCELERATE DEVELOPMENT OF THE SURF MINE  
CLEARING CONCEPT CALLED CATFAE (CATAPULT  
LAUNCHED FUEL-AIR EXPLOSIVE) FOR THE MARINES**

**RESPONSIBLE AGENCY: NAVY — MARINES**

**PRINCIPAL POC: LT COL GEORGE SOLHAN  
COMMANDANT MARINE CORPS RDD-21  
(202) 694-1411**





# AMPHIBIOUS ASSAULT COUNTERMINE SYSTEM

## REPRESENTATIVE AMPHIBIOUS ASSAULT COUNTERMINE PROBLEMS OF INTEREST TO DOD

- GENERAL
  - A MINE CLEARING CAPABILITY WHICH IS RAPID, CHEAP, REQUIRES MINIMAL LOGISTIC SUPPORT AND PERFORMS EFFECTIVELY FROM THE LAUNCH POINT TO THE BEACH
- CATFAE SPECIFIC
  - SAFELY TRANSITING FROM THE LAUNCH POINT TO THE SURF ZONE
  - FIRE CONTROL SYSTEM CAPABLE OF DELIVERING FAE ROUNDS IN A LINEAR OVERLAPPING PATTERN TO PRODUCE A BREACH LANE
  - ADEQUACY OF AAV (ASSAULT AMPHIBIOUS VEHICLE) TO SUPPORT THE WEIGHT OF THE CATFAE SYSTEM
  - MARKING THE CLEARED AREAS
  - SHIPBOARD STOWAGE OF FAE
  - OVERALL EFFECTIVENESS OF SYSTEM IN THE SURF ZONE





# **AMPHIBIOUS ASSAULT COUNTERMINE SYSTEMS**



## **MAJOR ELEMENTS OF A COMPREHENSIVE PROGRAM**

- **TEST EFFECTIVENESS OF LANDING CRAFT TO SAFELY TRANSIT TO SURF ZONE**
- **DEVELOP A SECOND ADVANCED DEVELOPMENT MODEL TO ACCELERATE TESTING OF CATFAE**
- **CONDUCT TESTS USING PROTOTYPE CATFAE UNDER REALISTIC OPERATING CONDITIONS**
- **IDENTIFY P3I UPGRADES FOR CATFAE TO ADDRESS ADVANCED HARDENED MINES (CASES AND FUSES)**
- **INVESTIGATE SYSTEM APPROACHES TO THE GENERAL PROBLEM THROUGH THE BROAD AGENCY ANNOUNCEMENTS**





# HIGH POWER MICROWAVES — NAVY



## OVERALL OBJECTIVES:

- CONDUCT A SYSTEMATIC AND COMPREHENSIVE INVESTIGATION OF HPM EFFECTS ON BOTH U.S. AND FOREIGN MILITARY EQUIPMENTS AND DEVELOP THE REQUIRED DATA BASE
- DEVELOP MODE CONVERTERS AND ANTENNAS NEEDED TO DIRECT SOURCE ENERGY ONTO TEST OBJECTS, TECHNIQUES FOR MODULATING MICROWAVE OUTPUT INTENSITY, AND CALIBRATED SOURCE DIAGNOSTICS

RESPONSIBLE AGENCIES: NAVY  
ARMY  
USAF  
DNA

PRINCIPAL POC: CAPT FONTANA  
NAVY SPAWAR PMW 145  
(202) 692-5691





# HIGH POWER MICROWAVES — NAVY

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## REPRESENTATIVE HPM PROBLEMS OF INTEREST TO DOD

- SUSCEPTABILITY AS A FUNCTION OF ELECTRONIC TECHNOLOGIES, RANGES, AND DESIGN APPROACHES
- LETHALITY-PULSE WIDTH, PULSE REPETITION RATES NEEDED TO KILL ELECTRONICS
- HARDENING — WHAT TYPES OF SHIELDING ARE EFFECTIVE AND HOW COSTLY ARE THEY
- WEAPONIZATION POTENTIAL OF TECHNOLOGIES





# HIGH POWER MICROWAVES — NAVY



## MAJOR ELEMENTS OF A COMPREHENSIVE DOD PROGRAM

- EFFECTS TESTING
  - PREDICT EFFECTS OF A BROAD RANGE OF IRRADIATION CONDITIONS FOR FAMILIES OF U.S. NAVY AND FOREIGN ELECTRONICS
  - CONDUCT HPM EXPERIMENTS IN THE LAB AND AT THE CAPISTRANO TEST SITE
  - PERFORM POST EXPERIMENT ANALYSIS
  - ASSIST THE DEFINITION OF HPM FAILURE MODES AND WEAPONIZATION POTENTIAL
- HPM COMPONENTS DEVELOPMENT
  - DEMONSTRATE TRANSPORTABLE MODERATE AND HIGH POWER SOURCES FOR SEVERAL FREQUENCY REGIMES
  - DEVELOP REPETITIVELY PULSED RETARGETABLE DEVICES CONCENTRATING ON PULSED POWER METHODS AND STEERABLE ANTENNA





# **HIGH ENERGY LASER FOR SHIP DEFENSE**

## **OVERALL OBJECTIVE:**

- **TO ASSESS THE POTENTIAL OF THE HIGH ENERGY  
LASER TO MEET FUTURE SURFACE SHIP  
REQUIREMENTS**

**RESPONSIBLE AGENCIES: NAVY  
SDIO**

**PRINCIPAL POC: CAPT FONTANA  
NAVY SPAWAR PMW 145  
(202) 692-5691**





# HIGH ENERGY LASER FOR SHIP DEFENSE



## REPRESENTATIVE HIGH ENERGY LASER PROBLEMS OF INTEREST TO DOD

- ACQUISITION, TRACKING AND LETHALITY
  - MOVING TARGETS
  - HIGH SPEED TARGETS
  - MANEUVERING TARGETS
  - MULTIPLE TARGETS
  - PRESENTATION ANGLE
  - VARIOUS WEATHER CONDITIONS
- COST PER ENGAGEMENT
- SHIPBOARD COMPATIBILITY





# HIGH ENERGY LASER FOR SHIP DEFENSE



## MAJOR ELEMENTS OF A COMPREHENSIVE DOD PROGRAM

- PERFORM LETHALITY PREDICTIONS BASED ON GROUND TEST DATA
- VERIFY LETHALITY USING A HIGH ENERGY LASER AGAINST REALISTIC TARGETS AT WSMR
- CONDUCT AN ANALYSIS OF PROGRAM DEVELOPMENT COSTS AND COSTS OF MOST LIKELY COUNTERMEASURES







# AIR FORCE BTI PROJECTS



## **AIR FORCE BALANCED TECHNOLOGY INITIATIVE PROJECTS**

Air Force participation in the BTI Program for FY 1987 involves work on 6 projects funded at a total of \$24.7 million. Specific projects include the following:

MILLIMETER WAVE SEEKER DEMONSTRATION  
AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS  
MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY  
HIGH POWER MICROWAVES  
CRUISE MISSILE ADVANCED GUIDANCE  
ADVANCED CLOSE AIR SUPPORT

Details regarding these projects are provided in the following charts.





## MILLIMETER WAVE (MMW) SEEKER DEMONSTRATION



### OVERALL OBJECTIVES

- o FREE-FLIGHT DEMONSTRATION OF LOW COST MMW SEEKER TECHNOLOGY MATED TO THE AGM-65 WEAPON FRAME
- o TO DEMONSTRATE SURVIVABLE, ALL WEATHER STANDOFF ATTACK CAPABILITY AGAINST MOBILE BATTLEFIELD/SECOND ECHELON TARGETS

RESPONSIBLE AGENCIES: SAF/AQQ  
AFSC/XR  
AD

PRINCIPAL POC: LT COL JIM SLATON  
SAF/AQQT  
(202) 695-0328





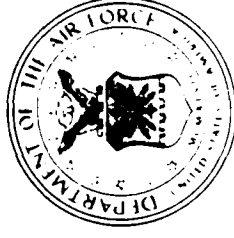
## **MILLIMETER WAVE (MMW) SEEKER DEMONSTRATION**



**THE PURPOSE OF THIS PROGRAM IS TO PROVIDE THE AIR FORCE AN AIR-DELIVERED, ALL WEATHER, AUTONOMOUSLY GUIDED, STANDOFF WEAPON FOR USE AGAINST FIXED AND MOBILE AIR DEFENSE UNITS, MOVING AND MASSED ARMOR, AND OTHER MOBILE BATTLEFIELD/SECOND ECHELON TARGETS BY 1994/1995.**

- COMPETITIVE PROGRAM TO CONDUCT FREE-FLIGHT DEMONSTRATIONS OF PROTOTYPE MMW MAVERICKS**
- TWO YEAR DEMONSTRATION PROGRAM TO LEAD TO FULL SCALE DEVELOPMENT PROGRAM (IN PLANNING)**





# **MILLIMETER WAVE (MMW) SEEKER DEMONSTRATION**

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## **MAJOR ELEMENTS**

- **TWO CONTRACTOR (MINIMUM) COMPETITIVE APPROACH**
- **FABRICATION AND ASSEMBLY OF PROTOTYPE MMW  
SEEKER**
- **INTEGRATION OF SEEKERS ONTO AGM-65 WEAPON  
FRAME**
- **FREE-FLIGHT DEMONSTRATIONS (4-5 LAUNCHES EACH  
CONTRACTOR) PROTOTYPE MMW MAVERICKS AGAINST  
CHARACTERISTIC BATTLEFIELD ARRAYS**





# **AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS**

## **OVERALL OBJECTIVES**

- **INCORPORATE NEAR-TERM AUTONOMOUS GUIDANCE  
SYSTEM INTO THE GBU-24**
- **TO DEVELOP AN AUTONOMOUS GUIDED WEAPON  
(AGW) FOR FIXED TARGETS**

**REASONABLE AGENCIES: SAF/AQQ  
AFSC/XR AND SD  
AD/YH**

**PRINCIPAL POC: LT COL JIM SLATON  
SAF/AQQT  
(202) 695-0328**





## **AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS**



**THE PURPOSE OF THIS PROGRAM IS TO PROVIDE THE AIR FORCE A DAY/NIGHT/ADVERSE WEATHER, LOCK-ON-AFTER-LAUNCH, STANDOFF WEAPON CAPABLE AGAINST FIXED TARGETS SUCH AS AIRFIELDS, BRIDGES, POWER PLANTS, AND POL FACILITIES. THREE TO FOUR YEAR FULL SCALE DEVELOPMENT (FSD) PROGRAM.**





# **AUTONOMOUS GUIDANCE FOR CONVENTIONAL WEAPONS**



## **MAJOR ELEMENTS**

- **COMPETITIVE PROGRAMMATIC APPROACH**
- **DEVELOP AUTONOMOUS GUIDED WEAPON**
  - **NEAR-TERM IMAGING INFRARED SEEKER SYSTEM  
INCORPORATED INTO GBU-24**
  - **COMPATIBLE WITH BOTH BLU-109 (FIRST) AND MK-84  
(SECOND) WARHEAD**





# **MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY**



## **OVERALL OBJECTIVES:**

**TO DEVELOP AN INTEGRATED AUTOMATIC TARGETING CAPABILITY TO PROVIDE INCREASED WEAPON SYSTEM SURVIVABILITY, HIGHER KILL-TO-PASS RATIO AND INCREASED ACQUISITION/RECOGNITION PERFORMANCE. TO DEMONSTRATE THAT THE SYNERGISTIC COMBINATION OF MULTI-SENSOR SIGNATURES WILL IMPROVE DETECTION AND CLASSIFICATION CONFIDENCES, REDUCE FALSE ALARMS, AND IMPROVE OVERALL IMMUNITY TO COUNTERMEASURES AND CAMOUFLAGE, CONCEALMENT AND DECEPTION MEASURES.**

**RESPONSIBLE AGENCIES: ASD**

**PRINCIPAL POC: HENRY LAPP  
AFWAL**

**(513) 255-5922 <sup>115</sup>**





# MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY



## BACKGROUND

- LABORATORY AUTOMATIC TARGET RECOGNIZERS HAVE DEMONSTRATED A LIMITED CAPABILITY.
- CHALLENGE REMAINS TO ENHANCE CURRENT CAPABILITY BY IMPROVING CLASSIFICATION PERFORMANCE, REDUCING FALSE ALARMS AND RELIABLY CUEING TARGETS IN COUNTERMEASURE AND CAMOUFLAGE, CONCEALMENT AND DECEPTION BATTLEFIELD ENVIRONMENT.
- LACK OF A CONCURRENTLY COLLECTED AND PROPERLY TRUTHED DATA BASE WITH INSTRUMENT QUALITY SENSORS IS THE PACING ISSUE LIMITING PROGRESS IN THE VALIDATION OF A VIABLE MULTI-SENSOR TARGETING TECHNOLOGY.





# **MULTI-SENSOR AUTOPROCESSOR TECHNOLOGY**



## **PLANS**

- **FABRICATE MULTI-SENSOR DATA COLLECTION SYSTEM**
- **LABORATORY AND AIRBORNE SENSOR CHARACTERIZATION**
- **COLLECT CONCURRENT MULTI-SENSOR DATA FOR DEVELOPMENT AND VALIDATION OF AUTOMATIC TARGET RECOGNIZERS. (FORWARD LOOKING INFRARED, SYNTHETIC APERTURE RADAR, MILLIMETER WAVE SENSORS AND CO2 LASER RADAR)**
- **OPTIMIZE MULTI-SENSOR AUTOMATIC TARGET RECOGNIZER ALGORITHMS (USAF / ARMY / NAVY, CONTRACTORS)**
- **DEMONSTRATE & VALIDATE A MULTI-SENSOR TARGETING APPROACH FOR CONVENTIONAL DEFENSE.**
- **GENERATE SYSTEM-LEVEL SPECIFICATIONS**





# **AIR FORCE**

## **HIGH POWER MICROWAVES**



- **OVERALL OBJECTIVES**
  - **QUANTIFY SUSCEPTIBILITY OF WEAPON SYSTEMS**
    - **DEVELOP HARDENING TECHNOLOGY**
  - **DEVELOP WEAPONIZATION TECHNOLOGY**
- **RESPONSIBLE AGENCIES: HQ AFSC**
  - AFWL**
  - RADC**
  - AFWAL**
- **PRINCIPAL POC: MAJOR WILLIAM C. DUNGAN**
  - HQ AFSC**
  - (301) 981-2554**





## **AF HPM TECHNOLOGY PROGRAM MAJOR PROGRAM EFFORTS**

- **DEVELOP RELIABLE SUSCEPTIBILITY/VULNERABILITY DATABASE**
  - **EFFECTS TESTING**
    - **MISSION CRITICAL COMPONENTS, SUBSYSTEMS, SYSTEMS**
  - **METHODOLOGY**
    - **DEVELOP STANDARDIZED TEST PROTOCOLS**
    - **VALIDATE PROCEDURES**
  - **PHENOMENOLOGY**
    - **UNDERSTAND ENERGY COUPLING MECHANISMS**
- **COMPONENTS DEVELOPMENT**
  - **SUPPORT EFFECTS EXPERIMENTS/WEAPONIZATION**





## **AF HPM TECHNOLOGY PROGRAM**

### **NEED FOR A STRONG HPM PROGRAM**

- LIMITED TESTING DEMONSTRATES SYSTEM SUSCEPTIBILITIES
- AF WEAPON SYSTEMS AT RISK
  - KNOWN SOVIET TECHNOLOGY/RESEARCH
  - UNKNOWN AF SYSTEM SUSCEPTIBILITIES/VULNERABILITIES
- ENHANCE MISSION CAPABILITIES
  - EXPLOIT POTENTIAL LETHALITIES
  - NEAR-TERM TECHNOLOGY



# **CRUISE MISSILE ADVANCED GUIDANCE (CMAG)**



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## **OVERALL OBJECTIVES**

- **DEVELOP / DEMONSTRATE MULTI-FUNCTION CRUISE MISSILE GUIDANCE**
  - **PRECISION TERMINAL HOMING**
  - **MIDCOURSE NAVIGATION**
  - **TERRAIN FOLLOWING / OBSTACLE AVOIDANCE**
  - **3-D MOBILE TARGET CLASSIFICATION / SUBMUNITION FIRE CONTROL**
  - **STRATEGIC DAMAGE ASSESSMENT**
- **EXPLOIT LASER RADAR AND TARGET RECOGNITION PROCESSOR TECHNOLOGIES FOR MANNED AIRCRAFT APPLICATIONS**

**RESPONSIBLE AGENCIES: AFWAL**

**RADC**

**DMA**

**PRINCIPAL POC: MR RON KAEHR**

**AFWAL/AVIONICS LABORATORY**

**(513) 255-2713**





# **CRUISE MISSILE ADVANCED GUIDANCE (CMAG)**



## **BACKGROUND**

- **CMAG IS CONTINUATION OF DARPA/AFWAL 6.2 AUTONOMOUS TERMINAL HOMING PROGRAM (1976-84)**
  - SELECTED BEST COMBINATION OF SUBSYSTEM TECHNOLOGY
  - DEMONSTRATION TECHNICAL FLEXIBILITY OF SELECTION APPROACH USING AIRBORNE SENSOR DATA AND NON-ROUTINE SIMULATIONS
- **CURRENT 6.3A EFFORT (1984-88)**
  - IMPROVE CO<sub>2</sub> LASER RADAR SENSOR/PROCESSOR CAPABILITY
  - CONDUCT REAL/TIME CAPTIVE FLIGHT TEST OF NAV/GUIDANCE FUNCTIONS
  - MAINTAIN COMPETITION AND TECHNOLOGY IMPLEMENTATION FLEXIBILITY
  - DEVELOP MISSION PLANNING APPROACHES COMPATIBLE WITH FORECASTED RECONNAISSANCE AND USER CAPABILITY





# **CRUISE MISSILE ADVANCED GUIDANCE (CMAG)**

## **STATUS/PLANS**

- CAPTIVE FLIGHT TESTING UNDER WAY
  - EARLY RESULTS - BOTH SYSTEMS WORK
- PLANNING INITIATED FOR FOLLOW-ON PROTOTYPE  
FREE-FLIGHT MISSILE DEMONSTRATION
- POSSIBLE P31 TO NUMEROUS CRUISE MISSILES
  - PAYOFFS: SUBSTITUTE CONVENTIONAL WEAPONS FOR NUCLEAR  
REDUCED COLLATERAL DAMAGE  
ROUTE FLEXIBILITY/INCREASED SURVIVABILITY  
REDUCED MISSION PLANNING TIME/COST
- APPLICATION SPINOFFS BEING CONSIDERED
  - TACTICAL 3-D RECONNAISSANCE SENSOR
  - SENSOR/ATR CANDIDATE FOR STRATEGIC RELOCATABLE TARGETS
  - AUTOMATED NAVIGATION/WEAPON FIRE CONTROL FOR MANNED  
AIRCRAFT





# **ADVANCED CLOSE AIR SUPPORT (CAS)/ BATTLEFIELD AIR INTERDICTION (BAI) TECHNOLOGY DEMO (AFTI/F-16)**

---



## **OVERALL OBJECTIVES**

- CONDUCT PHASED DEVELOPMENTS AND DEMONSTRATIONS THAT ADDRESS CAS/BAI REQUIREMENTS AND ISSUES, TO INCLUDE:
  - APPLICATION OF DIGITAL TERRAIN SYSTEM AND DATA LINK TO SURVIVABLE BATTLEFIELD PENETRATION
  - TECHNOLOGY APPLICATIONS FOR RAPID TARGET ACQUISITION AND WEAPON DELIVERY
  - APPLICATION OF AFTI/F-16 AIR-TO-AIR CAPABILITY TO CAS/BAI MISSION FOR SELF-DEFENSE

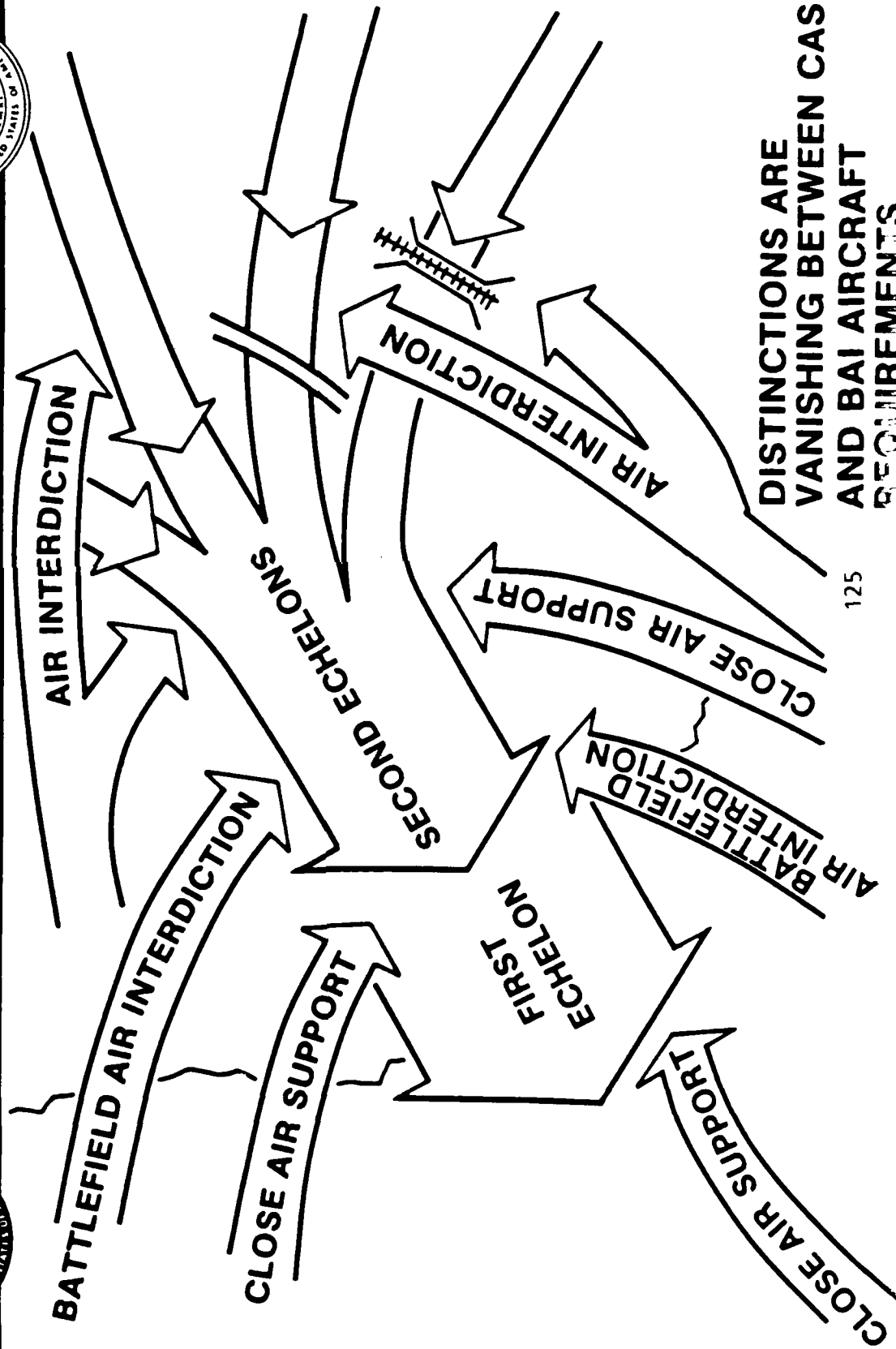
**RESPONSIBLE AGENCY: AFWAL**

**PRINCIPAL POC: MR DICK SWORTZEL  
AFWAL/FIGI  
(513) 255-8253**





# CAS/BAI RELATIONSHIP - 1990'S

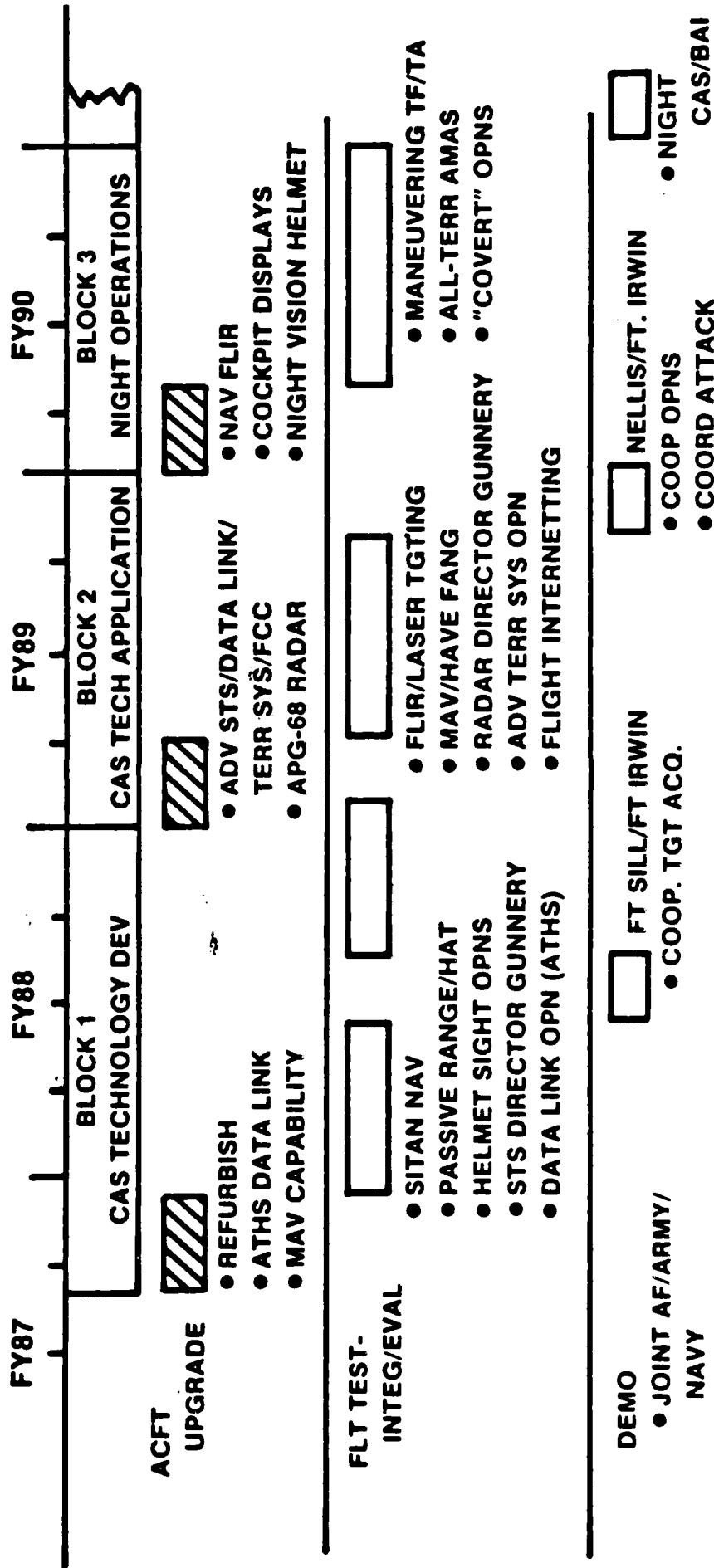


DISTINCTIONS ARE  
VANISHING BETWEEN CAS  
AND BAI AIRCRAFT  
REQUIREMENTS...





# CAS / BAI TECHNOLOGY FLIGHT TEST DEMONSTRATION





# **DEFENSE AGENCY BTI PROJECTS**



## DEFENSE AGENCY BALANCED TECHNOLOGY INITIATIVE PROJECTS

Defence Agency participation in the BTI Program for FY 1987 involves work on 23 projects funded at a total of \$70.5 million. Specific projects include the following:

### DARPA

MULTI-MISSION SEEKER DEVELOPMENT  
AUTOMATIC TARGET RECOGNITION FOR SMART WEAPONS  
DEEP BATTLE WEAPON CONCEPT  
GUIDED TACTICAL HYPERVELOCITY PROJECTILES  
MONOLITHIC INFRARED FOCAL PLANE ARRAYS  
EXPERT SYSTEM FOR MANUFACTURE OF SMART WEAPON COMPONENTS  
TACTICAL USE OF NATIONAL TECHNICAL MEANS  
OPTICAL SIGNAL PROCESSING TECHNOLOGY  
ENHANCED KINETIC ENERGY WEAPONS  
ADVANCED COMPOSITE GUN  
SHORT RANGE ANTI-TANK WEAPON  
ADVANCED MINE/COUNTERMINE TECHNOLOGY  
ARMOR MATERIALS  
ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPONS SYSTEM DEVELOPMENT  
PENETRATOR/TARGET INTERACTION FLASH X-RAY FACILITY  
ADVANCED SHORT TAKEOFF/VERTICAL LANDING TECHNOLOGY  
ACTIVE OPTICAL COUNTERMEASURES  
HIGH POWER/ENERGY DENSITY BATTERIES  
SUPERCONDUCTING CERAMIC MATERIALS

### DEFENSE PRODUCTION ENGINEERING SERVICES OFFICE

INFRARED FOCAL PLANE ARRAY PRODUCTIBILITY INITIATIVE



DEFENSE NUCLEAR AGENCY

HIGH POWER MICROWAVES

OUSD (OFFICE OF MUNITIONS)

ENHANCED BLAST MUNITIONS TECHNOLOGY BASE DEVELOPMENT

Details regarding these projects are provided in the following charts.









# **MULTI MISSION SEEKER DEVELOPMENT**



## **OBJECTIVE:**

- **DEVELOP AND DEMONSTRATE AN ADVANCED IR  
SEEKER CAPABLE OF LONG RANGE TARGET  
ACQUISITION AND RECOGNITION**

## **RESPONSIBLE AGENCIES:**

**DARPA  
CNVEO**

## **PRINCIPAL POC:**

**DR. JASPER LUPO  
DARPA/TTTO  
(202) 694-2569**

**PROGRAM IS CLASSIFIED AND SOLE SOURCE**





## **AUTOMATIC TARGET RECOGNITION FOR SMART WEAPONS**



- ▶ **Overall objectives**
  - **To develop mission enabling automatic target recognition technology for application to a large variety of smart weapon systems**
  - **To advance the state of the art in processing signals from multiple sensor inputs by fusing the presented information and raising the perception level of systems attempting to understand images**
- ▶ **Responsible agent: DARPA**
- ▶ **Principal POC: Dr. Jasper Lupo, DARPA (202) 694-2569**





## **AUTOMATIC TARGET RECOGNITION FOR SMART WEAPONS**



- ▶ **Major program elements**
  - **Fundamental studies will be conducted on:**
    - **Image processing**
    - **Target and background signature collection**
    - **Multi-sensor integration**
    - **Signal processing and decision-making software**
    - **Target prioritization schemes**
    - **Air system architectures**
  - **Development and testing will be conducted on the application of neural net processing to the imagery of multi-sensor suites**





## **AUTOMATIC TARGET RECOGNITION FOR SMART WEAPONS**



- ▶ **National defense needs addressed**
  - **Enabling technology will be developed to allow a variety of weapon systems to penetrate the camouflage, countermeasures, and deception of high value enemy targets**
- ▶ **Major program milestones**
  - **BAA on neural nets workshop** Early FY 88
  - **Multi-sensor suite initial flight** Early FY 88
  - **RFQ for ATR technology advancement** Mid FY 88
  - **Sensor flights against target models** Mid FY 88
  - **Initial test of neural net processing** Late FY 88
  - **Validate new simulation techniques** FY 89
  - **Develop and demonstrate sensor suites** FY 90
  - **Complete flight testing** FY 91





# DEEP BATTLE WEAPON CONCEPT



## OBJECTIVE

- DEVELOP AND EVALUATE AN ADVANCED SENSOR FUZED DEEP BATTLE WEAPON FOR POTENTIAL DELIVERY BY TACTICAL SSM's
- PROVIDE LARGER AREA SEARCH CAPABILITY THAN PRESENT SENSOR FUZED MUNITIONS

## RESPONSIBLE AGENCIES:

DARPA  
MICOM

## PRINCIPAL POC:

DR. JASPER LUPO  
DARPA/TTO  
(202) 694-2569

PROGRAM IS CLASSIFIED AND SOLE SOURCE





# **GUIDED TACTICAL HYPERVELOCITY PROJECTILE**



- **OVERALL OBJECTIVES**
  - TO DEVELOP PROJECTILES AND ASSOCIATED FIRE CONTROL TECHNOLOGIES CAPABLE OF DEFEATING ENEMY ADVANCED ARMOR AND AIR TARGETS WITH A MOBILE, HYPERVELOCITY GUN WEAPON SYSTEM
  - TO DEVELOP AND DEMONSTRATE THE INTEGRATED PROJECTILE AND FIRE CONTROL SYSTEM AND TEST IT WITH CONVENTIONAL AND HYPERVELOCITY GUNS
- **RESPONSIBLE AGENT: DARPA; ARDEC**
- **PRINCIPAL POC: DR. JASPER LUPO, DARPA,  
(202) 694-2569**





# **GUIDED TACTICAL HYPERVELOCITY PROJECTILE**



- 
- **MAJOR PROGRAM ELEMENTS**
  - **PROJECTILE DEVELOPMENT ENCOMPASSING**
    - AERODYNAMICS AND HEATING
    - LAUNCH ENVIRONMENT
    - GUIDANCE AND CONTROL
    - WARHEADS AND FUZING
  - **FIRE CONTROL ENCOMPASSING**
    - AUTONOMOUS SEARCH AND ACQUISITION
    - SENSOR SUITE SELECTION
    - IDENTIFICATION OF FRIEND OR FOE
    - COMMAND GUIDANCE OF MULTIPLE PROJECTILES AGAINST MULTIPLE TARGETS





# **GUIDED TACTICAL HYPERVELOCITY PROJECTILE**



- 
- **NATIONAL DEFENSE NEEDS ADDRESSED**
    - EXPLOITATION OF HYPERVELOCITY GUN TECHNOLOGY WILL BE ACHIEVED THROUGH DEVELOPMENT OF A NEW PROJECTILE AND APPROPRIATE FIRE CONTROL TO RAPIDLY DEFEAT ENEMY ARMOR AND AIR THREATS THUS HELPING TO COUNTER NUMERICAL SUPERIORITY ON THE CONVENTIONAL BATTLEFIELD
  - **MAJOR PROGRAM MILESTONES**

• RFQ ISSUED FOR PROJECTILES AND FIRE CONTROL	LATE FY87
• DESIGN OF PROJECTILE AND FIRE CONTROL	EARLY FY88
• CRITICAL COMPONENT DEMONSTRATIONS	MID FY89
• SYSTEMS DEMONSTRATIONS	EARLY FY92





## **MONOLITHIC INFRARED FOCAL PLANE ARRAYS (FPAs)**



- ▶ **Overall objectives**
  - **To demonstrate reproducible growth of high quality IR detector materials over large areas**
  - **To demonstrate "silicon-line" processing of monolithic FPA ICs in mercury-based alloys**
  - **To demonstrate feasibility of affordable and reliable monolithic IR focal plane arrays**
- ▶ **Responsible agencies: DARPA, AFOSR, ARO, NRL**
- ▶ **Principal POC: Dr. James Murphy, DARPA (202) 694-3145**





## **MONOLITHIC INFRARED FOCAL PLANE ARRAYS**



- ▶ **Major elements of a comprehensive program**
  - **Bulk and epitaxial growth of defect-free Hg-based alloys over large areas**
  - **Materials characterization**
  - **Design and modeling of detection and signal processing circuits**
  - **Detector array fabrication and testing**
  - **Signal processor fabrication and testing**
  - **Monolithic detector array/signal processor module fabrication and testing**





## **MONOLITHIC INFRARED FOCAL PLANE ARRAYS**



- ▶ **Representative DoD tactical applications for IRFAs**
  - **Smart munitions (anti-armor, tank, ship, aircraft, etc.)**
  - **Target acquisition (weapon sites, etc.)**
  - **Surveillance (land, sea, air) (threat warning, search attack, intelligence)**
  - **Navigation**
  - **Active imaging**





## **EXPERT SYSTEMS FOR MANUFACTURE OF SMART WEAPONS COMPONENTS**



- ▶ **Overall objectives**
  - **Develop and demonstrate a fully integrated approach for the design, manufacture, and maintainability of smart weapons components and systems**
  - **Reduce manufacturing costs by at least 50 percent**
- ▶ **Responsible agency: DARPA**
- ▶ **Principal POC: Dr. Phillip A. Parrish**  
**DARPA (202) 694-1303**





## **EXPERT SYSTEMS FOR MANUFACTURE OF SMART WEAPONS COMPONENTS**



- ▶ **Representative problems of interest to DoD**
  - **Cost reduction in manufacturing critical subassemblies**
  - **Production of relatively low volumes of specific items economically**
  - **Flexibility for fast turnaround on line**
  - **Applications to AMRAAM, MLRL, Copperhead**





## **EXPERT SYSTEMS FOR MANUFACTURE OF SMART WEAPONS COMPONENTS**



- ▶ Major elements of a comprehensive program
  - Utilization of machine intelligence to develop new manufacturing concepts
    - Pattern recognition
    - Intelligent processing
    - Real time computer control
    - Robotics
  - Development of methodology
    - Expert unit processes
    - Computer aided design
    - Automated in-process inspection and quality control
    - Flexible, reprogrammable work cells





# **TACTICAL USE OF NATIONAL TECHNICAL MEANS**



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## **OBJECTIVE**

**TO DEVELOP DATABASES AND TECHNOLOGIES**

## **RESPONSIBLE AGENCIES:**

**DARPA  
USAETL**

## **PRINCIPAL POC:**

**DR. JUDITH DALY  
DARPA/TTO  
(202) 694-2394**

**PROGRAM IS CLASSIFIED AND SOLE SOURCE**





## **OPTICAL SIGNAL PROCESSING TECHNOLOGY**

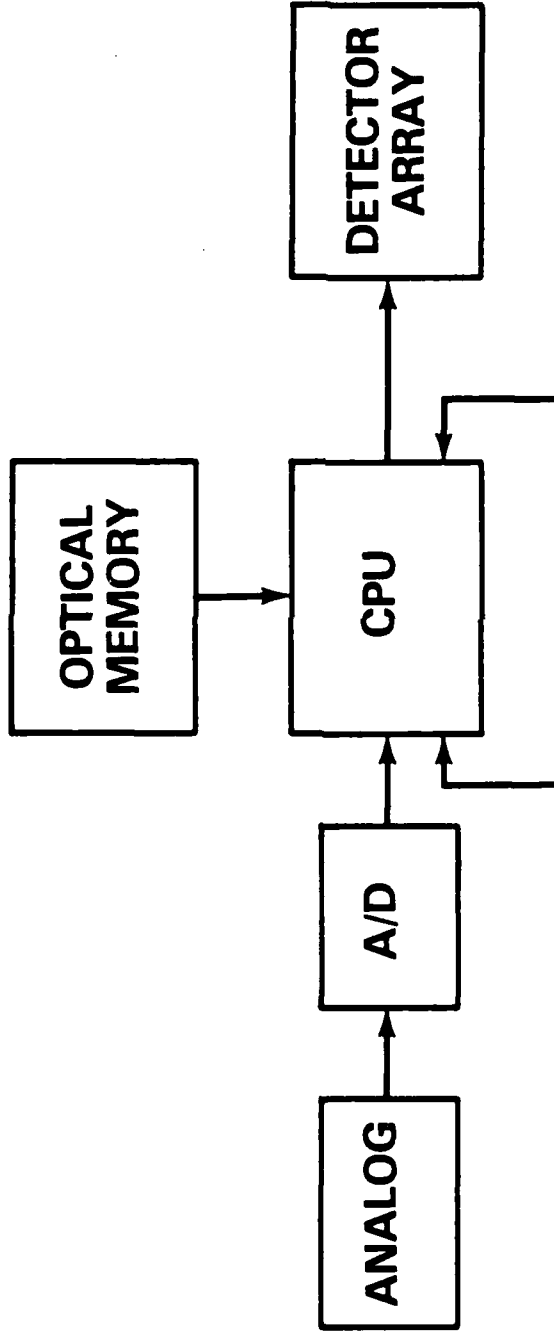


- ▶ **Overall objective**
  - **Demonstrate the suitability of optical signal processing technology for demanding data handling applications**
- ▶ **Responsible agencies: DARPA, RADC, HDL, NRL, ONR**
- ▶ **Principal POC: Dr. John Neff, DARPA, (202) 694-3145**





# OPTICAL SIGNAL PROCESSING TECHNOLOGY



**CRITICAL DEVICES:** ANALOG MODULATORS  
A/D CONVERTERS  
2D SPATIAL LIGHT MODS.  
HIGH DENSITY MEMORY  
SMART DETECTOR ARRAYS





## **OPTICAL SIGNAL PROCESSING TECHNOLOGY**



- ▶ **Early program goals (first three years)**
  - **Define architectures for high bandwidth radar, wideband communications, database and knowledgebase processing, and electronics warfare**
  - **Develop critical devices**
- ▶ **Late program goals (last two years)**
  - **"Fine-tune" devices**
  - **Assemble three or four demonstrations**





# ENHANCED KINETIC ENERGY WEAPONS



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## OVERALL OBJECTIVES

- DEVELOP KINETIC ENERGY PROJECTILES THAT HAVE A FIRST ROUND KILL CAPABILITY AT 3KM OR BEYOND AGAINST CURRENT OR PROJECTED ARMORED VEHICLES.
  - DEMO WITH FIELDED 20mm GUN
  - SCALABLE TO FIELDED 105mm GUN

## RESPONSIBLE AGENCIES

DARPA  
ARDEC

## PRINCIPAL POC:

MAJ RANDY LUNDBERG  
DARPA/TTO  
(202) 694-8379





# ENHANCED KINETIC ENERGY WEAPONS



## MAJOR ELEMENTS AND TECHNOLOGY ISSUES:

- **EXTERNAL PROPULSION**
  - LAUNCH SURVIVABILITY OF ROCKET OR RAMJET
  - ATTAINMENT OF LETHAL VELOCITY IN MINIMUM RANGE
    - ROCKET MASS FRACTION AND BURN RATE
    - RAMJET IGNITION AND ACCELERATION
- **GUIDANCE AND CONTROL**
  - G&C SYSTEM WEIGHT
  - FORWARD LOOKING SEEKERS
  - OBSCURATION OF COMMAND GUIDANCE TRACKER BY GUN BLAST AND BOOST PROPULSION
- **LETHALITY**
  - PENETRATOR CONFIGURATION AND WEIGHT
  - LAUNCH SURVIVABILITY OF ADVANCED PENETRATORS





# **ENHANCED KINETIC ENERGY WEAPONS**



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## **ANTICIPATED PRODUCTIONS AND APPLICATIONS**

- ADVANCE SOA OF PROPULSION, G&C, AND KE PENETRATORS OF GUN LAUNCHED PROJECTILES
  - COMPONENT TECHNOLOGIES APPLICABLE TO MISSILES
- DEMONSTRATION OF INTEGRATED PROJECTILE AND FIRE CONTROL SYSTEM THAT WILL SIGNIFICANTLY EXTEND THE EFFECTIVE RANGES OF DEPLOYED 120mm AND 105mm WEAPON SYSTEMS





# **ADVANCED COMPOSITE GUN**



- **OVERALL OBJECTIVE:**
  - TO DEMONSTRATE GREATLY IMPROVED LETHALITY IN GUN SYSTEMS BY EXPLOITING COMPOSITE MATERIALS AND COMPUTER DESIGN TECHNOLOGY. IMPROVEMENTS DESIRED ARE:
    - HIGHER PRESSURE
    - HOTTER PROPELLANTS
    - GREATER HEAT INPUT CAPABILITY
    - GREATER BARREL STIFFNESS
    - LOW BARREL EROSION
- **RESPONSIBLE AGENCIES: DARPA, U.S. ARMY (ARDEC)**
- **PRINCIPAL POC: DR. GENE FARNUM, DARPA,  
(202) 694-1303**





# ADVANCED COMPOSITE GUN



- 
- **BENEFITS TO DoD ARMAMENT NEEDS**
    - LONG RANGE, LONG BARREL LIFE, LIGHT ARTILLERY
    - HIGH VELOCITY, ACCURATE TANK CANNONS
    - EXTENDED RAPID-FIRE BURSTS FOR AIR DEFENSE CANNONS
    - LIGHTWEIGHT, SHORT TIME-OF-FLIGHT AIR-TO-AIR MACHINE GUNS
    - HIGH VELOCITY, ACCURATE ANTIARMOR AUTOMATIC CANNONS
    - LIGHTWEIGHT, RAPID FIRE, LONG BARREL LIFE MACHINE GUNS





# **ADVANCED COMPOSITE GUN**



- **DEVELOPMENT PROGRAM LEADS TO A HIGH PERFORMANCE RAPID FIRE PROTOTYPE IN MEDIUM CALIBER IN FOUR YEARS**
- 1) ADVANCED FINITE ELEMENT COMPUTER DESIGN WITH MULTILAYER COMPOSITE MATERIALS**
- 2) MATERIAL SELECTION AND PROPERTY OPTIMIZATION**
  - CERAMIC MATRIX COMPOSITES
  - REFRACTORY METAL ALLOYS AND COMPOSITES
  - HIGH TEMPERATURE POLYMER/GRAPHITE COMPOSITES
- 3) CONSTRUCT AND FIRE HIGH PERFORMANCE BARREL/BREECH TEST-BED**
- 4) INCORPORATE THERMAL CONTROL, RECOIL SUPPRESSION AND HIGH-STRENGTH, LIGHTWEIGHT MATERIALS IN GUN SYSTEM DESIGN**
- 5) BUILD PROTOTYPE CANNON FOR SERVICE EVALUATION**





# **SHORT RANGE ANTI-TANK WEAPON (SRAW) PROJECT**



---

## **OVERALL OBJECTIVE:**

- DESIGN AND TEST A LIGHTWEIGHT, SHORT-RANGE, SELF-DEFENSE, ANTI-TANK WEAPON CAPABLE OF DEFEATING CURRENT AND PROJECTED TANKS AT RANGES OF 300-500m.

## **RESPONSIBLE AGENCIES:**

**DARPA  
MCDEC**

## **PRINCIPAL POC:**

**MAJ RANDY LUNDBERG  
DARPA/TT0  
(202) 694-8379**





# **SHORT-RANGE ANTI-TANK WEAPON (SRAW) PROJECT**



## **TECHNICAL CHALLENGES**

- MAJOR REDUCTIONS IN KEY COMPONENT WEIGHT AND VOLUME:
  - WARHEAD
  - PROPULSION
  - SENSOR/FUZE
  - CONTROL SYSTEM
  - LAUNCHER
- INTEGRATE EXISTING TECHNOLOGIES WHENEVER POSSIBLE TO REDUCE PRODUCTION COSTS

## **PROGRAM PLAN**

- BRIEFING TO INDUSTRY – LATE FALL
- PHASE I – DETAILED DESIGNS
- PHASE II – CRITICAL TECHNOLOGY DEMONSTRATIONS
- PHASE III – SYSTEM INTEGRATION AND TEST





# ADVANCED MINE/COUNTERMINE TECHNOLOGY



## OVERALL OBJECTIVES

- TO DEVELOP HIGH PAYOFF CONCEPTS AND TECHNOLOGIES FOR LAND MINES AND COUNTERMINE OPERATIONS
- SPECIFIC AREAS OF INITIAL FOCUS INCLUDE
  - COMMAND AND CONTROL LINKS
  - ANTI-HELICOPTER MINES
  - STANDOFF MINE DETECTION
- BRIEFING TO INDUSTRY GIVEN ON JULY 23
  - RESPONSES DUE SEPTEMBER 9

## RESPONSIBLE AGENCIES:

DARPA  
ARDEC  
BRDEC

## PRINCIPAL POC:

MR. TOM HAHER  
DARPA  
(202) 694-8378





# ADVANCED MINE/COUNTERMINE TECHNOLOGY



## ANTICIPATED PRODUCTIONS AND APPLICATIONS

- **COMMAND AND CONTROL LINK**
  - DENY ENEMY PASSAGE BUT PERMIT FRIENDLY PASSAGE
  - INCREASE EFFECTIVENESS OF MINEFIELD
  - PERMIT MINES TO FUNCTION AS INTELLIGENCE GATHERING DEVICES
- **ANTI-HELICOPTER MINE**
  - DENY NAP-OF-THE-EARTH OVERFLIGHT BY ENEMY HELICOPTERS
  - ATTACK ENEMY FORWARD AREA REFUEL/REARM POINTS
  - DISRUPT ENEMY AIR BASE OPERATIONS
- **MINE DETECTION SYSTEM**
  - PROVIDE SUFFICIENT WARNING OF MINE PRESENCE TO AVOID ENCOUNTER
  - ALLOW DEMILITARIZATION OF MINED AREAS
  - DISCOVER/INTERDICT TERRORIST DEVICES





# ADVANCED MINE/COUNTERMINE TECHNOLOGY



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## MAJOR ELEMENTS AND TECHNOLOGIES

- COMMAND AND CONTROL LINK
  - ENCRYPTION/SECURITY DEVICES
  - LOW PROBABILITY OF INTERCEPT COMMUNICATIONS
  - NETWORKING PROTOCOLS
- ANTI-HELICOPTER
  - PASSIVE OR COVERT GROUND SENSORS
  - WARHEADS/LETHAL MECHANISMS
  - NON-COOPERATIVE IFF
- MINE DETECTION SYSTEM
  - GROUND PENETRATING RADAR
  - NEUTRON ABSORPTION/RERADIATION TECHNIQUES
  - MULTISENSOR REAL TIME PROCESSING





# **ARMOR MATERIALS**



- **OVERALL OBJECTIVES**
  - TO IMPROVE UNDERSTANDING OF THE RESPONSE OF HIGH-PERFORMANCE CERAMICS TO BALLISTIC IMPACT
  - TO DRAMATICALLY REDUCE THE COST OF HIGH BALLISTIC PERFORMANCE CERAMIC ARMOR
  - TO DEVELOP IMPROVED LOW-COST ARMOR MATERIALS AND NOVEL HIGH PERFORMANCE ARMOR CONCEPTS
- **RESPONSIBLE AGENCIES: DARPA, ARO**
- **PRINCIPAL POC: DR. GENE FARNUM,  
DARPA, (202) 694-1303**





# ARMOR MATERIALS



- 
- **SERVICE NEED: HIGH MASS EFFICIENCY ARMOR AT LOW COST**
    - EMERGING THREATS OF HEAVY METAL APFSDS PENETRATORS IN ALL CALIBERS FROM 7.62 TO 125 mm TANK GUN
    - NEW GUIDANCE TECHNOLOGY AND GREATER NUMBERS ARE INCREASING THE THREAT FROM ANTIARMOR MISSILES
    - "LIGHT" FIGHTING VEHICLES WILL NEED ARMOR TO DEFEAT THESE THREATS BUT CANNOT AFFORD THE ADDED WEIGHT OF METALLIC ARMOR
    - CERAMIC ARMOR SYSTEMS HAVE DEMONSTRATED HIGH MASS EFFICIENCY
    - BUT, FIGHTING VEHICLES CANNOT AFFORD THE CURRENT HIGH COST OF BALLISTIC CERAMICS
    - DEVELOPMENT OF EVEN BETTER ARMOR IS IMPEDED BY INADEQUATE UNDERSTANDING OF THE FAILURE OF HARD MATERIALS





# ARMOR MATERIALS



- 
- ADDRESSING THE PROBLEMS IN ADVANCED ARMORS
    - EXPERIMENTAL AND ANALYTICAL STUDIES OF FAILURE AND POST-FAILURE FLOW OF HARD MATERIALS
    - DEVELOPMENT OF NEW PROCESSING TECHNOLOGIES THAT WILL PRODUCE LOW-COST, NET-SHAPE CERAMIC ARMOR TILES
    - DEVELOPMENT OF MATERIALS AND CONCEPTS FOR LIGHTWEIGHT, HIGH-EFFICIENCY EXPLOSIVE REACTIVE ARMOR
    - DEVELOPMENT OF IMPROVED ARMOR MATERIALS BY TAILORED MICROSTRUCTURES, NEW CERAMIC "ALLOYS" AND CERAMIC/METAL COMPOSITES





## **ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPON SYSTEM DEVELOPMENT**



- ▶ **Overall objectives**
  - **To develop improved understanding of the response of real materials to dynamic loading**
  - **To formulate physically-based constitutive models for describing such behavior for use in solving complex computational mechanics problems of interest to DoD**
- ▶ **Responsible agencies: DARPA, ONR, ARO**
- ▶ **Principal POC: Dr. Gene Farnum, DARPA,  
(202) 694-1303**





## **ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPON SYSTEM DEVELOPMENT**



- ▶ **Representative computational problems of interest to DoD**
  - **Analyses of structural impacts at high velocities**
  - **Design and evaluation of conventional munitions (e.g., shaped charges, EFPs, advanced mines)**
  - **Analyses of penetrator/target interaction phenomena and performance of advanced armor systems**
  - **Analyses of blast loading and effects on soils and structures**
  - **Combustion and explosion phenomena**
  - **Analyses related to the dynamic properties characterization of new materials and components being developed for military systems**





## **ENHANCED COMPUTATIONAL CAPABILITIES FOR ADVANCED WEAPON SYSTEM DEVELOPMENT**



- ▶ **Major elements of a comprehensive program**
  - **Experimental studies and analyses**
  - **Development of micromechanics models**
  - **Development of compatible macroscopic material constitutive models**
  - **Development of reliable numerical algorithms for implementing models in large-scale computer simulation programs**
  - **Experimental verification/validation of advanced computational capabilities**
  - **Demonstration of applicability to complex DoD problems**





# **PENETRATOR/TARGET INTERACTION FLASH X-RAY FACILITY**



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**OBJECTIVE: TO ESTABLISH A HIGH-ENERGY FLASH X-RAY FACILITY TO  
BE USED IN STUDYING THE INTERACTION OF VARIOUS  
MUNITIONS WITH ADVANCED ARMOR SYSTEMS  
FOLLOWING IMPACT. A PULSED X-RAY MACHINE HAVING  
PEAK ENERGY IN THE RANGE OF 5-8 MeV WILL BE  
DEVELOPED, TOGETHER WITH SUPPORTING DIAGNOSTICS**

**RESPONSIBLE AGENCY: DARPA**

**PRINCIPAL POC: MR. JOHN ENTZMINGER  
DARPA  
(202) 694-2440**

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# **ADVANCED SHORT TAKEOFF/VERTICAL LANDING (ASTOVL) TECHNOLOGY**

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**OBJECTIVE: TO ACCELERATE THE DEVELOPMENT OF  
TECHNOLOGIES LEADING TO FLIGHT TEST  
DEMONSTRATIONS OF THE MILITARY POTENTIAL  
OF ASTOVL AIRCRAFT BY THE EARLY 1990'S**

**RESPONSIBLE AGENCY: DARPA**

**PRINCIPAL POC: MR. LARRY GETTSMA  
DARPA  
(202) 694-2723**





# **ADVANCED SHORT TAKEOFF/VERTICAL LANDING (ASTOVL) TECHNOLOGY**



**WORK WILL SUPPORT A JOINT US/UK ASTOVL TECHNOLOGY  
PROGRAM INITIATED IN FY 1986 AS PART OF THE NATO  
COOPERATIVE R&D PROGRAM**

## **SPECIFIC PROGRAM ACTIVITIES:**

- DEVELOPMENT OF AN INTEGRATED  
FLIGHT/PROPULSION CONTROL (IFPC) SYSTEM  
UNIQUE TO ASTOVL AIRCRAFT**
- MODIFICATION OF HIGH THRUST-TO-WEIGHT ENGINES  
FOR ASTOVL PROPULSION**
- JET-EFFECTS AND AERODYNAMIC STUDIES RELATED  
TO ADVANCED AIRFRAMES**





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## ACTIVE OPTICAL COUNTERMEASURES

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### OVERALL OBJECTIVE

- DEVELOP AND DEMONSTRATE TECHNOLOGY TO OVERCOME SIZE-PERFORMANCE GAP FOR FUTURE ANTI-SENSOR WEAPON

RESPONSIBLE AGENCIES: DARPA  
LINL

PRINCIPAL POC: DR. SHEN SHEY  
DARPA  
(202) 694-1959

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## ACTIVE OPTICAL COUNTERMEASURES

### BTI PROGRAM BUILDS ON CURRENT DARPA INVESTMENTS

- SOLID STATE LASER TECHNOLOGY BASE
- SIMNET-D (AOCM)
- BASILISK SPECIFIC SCIENCE & TECHNOLOGY

### MAJOR ELEMENTS OF BTI PROGRAM

- RAPID PROTOTYPING OF CRITICAL SUBSYSTEMS, WHEN APPROPRIATE
- DEVELOP AND EVALUATE BASILISK DEMONSTRATOR

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## ACTIVE OPTICAL COUNTERMEASURES

### REPRESENTATIVE TECHNOLOGIES OF INTEREST

- ADVANCED LASER GLASS AND CRYSTAL MATERIALS
- HIGH DAMAGE THRESHOLD OPTICAL COATINGS
- WAVELENGTH DIVERSITY TECHNIQUES AND MATERIALS
- COMPACT, RELIABLE, AFFORDABLE LASER SYSTEM DESIGN
- ADVANCED LASER SYSTEM TECHNOLOGY (RAM)
  - ADAPTIVE OPTICS
  - PHASE CONJUGATION
  - ACCURATE POINTING
  - COMPACT POWER SOURCE
  - COMPACT EFFICIENT COOLING

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## **HIGH POWER/ENERGY DENSITY BATTERIES**



- ▶ **Overall objective**
  - **Develop efficient high power/energy sources to meet high-performance operational requirements for military systems such as space platforms, advanced missiles and precision guided munitions**
- ▶ **Responsible agencies: DARPA, AFWAL, ARO**
- ▶ **Principal POC: Dr. F. W. Patten, DARPA, (202) 694-1303**





## HIGH POWER/ENERGY DENSITY BATTERIES



- ▶ Requirements
  - Compact
  - Lightweight
  - Low life cycle costs, maintenance
  - High reliability
- ▶ Expected capabilities compared to conventional battery systems
  - 10-20× increase in pulsed power
  - 10× reduction in weight and volume





## HIGH POWER/ENERGY DENSITY BATTERIES



- ▶ Present DARPA-sponsored efforts
  - Dynamic cell technology development
  - Superionics
  - Sodium/sulfur electrochemical cells
- ▶ Trends
  - Other candidates than sodium/sulfur and lithium/acid systems
  - Potential battery/capacitor combination systems





## **SUPERCONDUCTING CERAMIC MATERIALS**



- ▶ **Overall objectives**
  - **Develop materials processing and fabrication approaches to producing thin film and bulk superconductors with transition temperatures at or above 90° Kelvin**
  - **The superconductors should have appropriate properties and shapes useful for large- and small-scale applications**
  - **Suitable demonstrations based on the proposed technical approach should lead as quickly as possible to manufacturing of devices, machines, and products of interest to the DoD**
- ▶ **Responsible agencies: DARPA, ONR**
- ▶ **Principal POC: Dr. Kay A. Rhyne, DARPA, (202) 694-1303**





## **SUPERCONDUCTING CERAMIC MATERIALS**



- ▶ **Representative applications of interest to DoD**
  - **Thick and thin films**
    - Primarily related to electronic devices
    - Computer interconnects and devices, sensors, detectors, millimeter waves components, power transmission (coatings), etc.
  - **Wires, filaments, tapes**
    - Primarily large scale devices
    - Cavities, power transmission, energy storage magnets, small research magnets, accelerator magnets, NMR imaging magnets, fusion magnets, power generators and motors, etc.





## **SUPERCONDUCTING CERAMIC MATERIALS**



- ▶ **Major elements of a comprehensive program**
  - **Synthesis, processing, fabrication of materials in engineering shapes and sizes**
    - **Complete characterization**
    - **Component demonstration**
    - **Viability for use in advanced manufacturing scenario**
  - **Materials should have electrical, magnetic, mechanical, etc. properties sufficient for application**
  - **Shorten research and development time to production**
  - **Contribute to a viable industrial base for fabrication and manufacturing**





# **INFRARED FOCAL PLANE ARRAY PRODUCIBILITY INITIATIVE (IRFPA)**



## **OVERALL OBJECTIVE:**

- **TO DEVELOP AND IMPLEMENT A NON-CONFIGURATION DEPENDENT  
MANUFACTURING PROCESS FOR IRFPAs TRANSPARENT TO RESEARCH  
AND DEVELOPMENT INNOVATIONS**

**RESPONSIBLE AGENCY: DOD PRODUCT ENGINEERING SERVICES OFFICE**

**PRINCIPAL POC:            ROGER N. KOREN  
                                     DPESO  
                                     (703) 756-8994**





# **INFRARED FOCAL PLANE ARRAY PRODUCIBILITY INITIATIVE (IRFPA)**



## **REPRESENTATIVE IRFPA PRODUCIBILITY PROBLEMS OF INTEREST TO DOD**

- **NON-CONFIGURATION DEPENDENCY**
- **MATERIAL TECHNOLOGY INDEPENDENCY**
- **TRANSPARENCY TO INNOVATION**
- **SPECIAL TOOLS/TEST EQUIPMENT**
- **STANDARDS/METROLOGY**
- **MATERIAL HARDENING**
- **CAD/CAM/CIM STANDARDIZATION**





# INFRARED FOCAL PLANE ARRAY PRODUCIBILITY INITIATIVE (IRFPA)



## BUILDING THE FOUNDATION FOR A COMPREHENSIVE PRODUCIBILITY PROGRAM

- OVERCOME LIMITATIONS IN CURRENT MANUFACTURING METHODS FOR IRFPAs ACROSS MATERIAL (PtSi, InSb, MCT, Si:X), OPERATING TEMPERATURE, AND WAVELENGTH
- IDENTIFY IRFPA STANDARDS/METROLOGY AND SPECIAL TOOLS/TEST EQUIPMENT REQUIREMENTS
- DEMONSTRATE APPLICATION OF CAD/CAM/CIM TO IRFPA
- RESOLVE COMMON PRODUCIBILITY ISSUES ACROSS MATERIAL, TEMPERATURE, WAVELENGTH, ETC.
- ESTABLISH BASELINE CONFIGURATION GUIDANCE FOR IRFPAs

## FOLLOW-ON WORK FOR FY88-92 UNDER PE 72807D

- PARAMETER DEFINITION, PRODUCTION LINE DESIGN, AND FABRICATION FOR PtSi AND InSb AS NEAR TERM AND POTENTIALLY LOW-COST APPROACHES
- PARAMETER DEFINITION, PRODUCTION LINE DESIGN, AND FABRICATION FOR MCT AND Si:X AS CRITICAL BUT LESS MATURE MATERIALS
- WEAPON SYSTEM PROGRAM MANAGERS WILL CAPITALIZE ON PRODUCTION LINES AS THEIR REQUIREMENTS ARE REALIZED





## **HIGH POWER MICROWAVES**

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**OBJECTIVE: TO SUPPORT ADDITIONAL WORK IN THE AREAS OF HPM  
EFFECTS TESTING, HPM COMPONENTS DEVELOPMENT, AND  
HPM PROPOGATION/PHENOMENOLOGY COMPLEMENTARY  
TO ONGOING DNA AND SERVICES ACTIVITIES**

**RESPONSIBLE AGENCY: DEFENSE NUCLEAR AGENCY**

**PRINCIPAL POC: MR. JON FARBER  
DNA  
(703) 325-7087**





# ENHANCED BLAST MUNITIONS TECHNOLOGY BASE DEVELOPMENT

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- **OVERALL OBJECTIVES:**
  - BUILD THE TECHNOLOGY BASE NEEDED FOR THE DESIGN AND DEVELOPMENT OF SAFE, RELIABLE, HIGH-YIELD, AND HIGH-EFFICIENCY BLAST WEAPONS BASED ON FUEL-AIR EXPLOSIVES
  - COMPILE AND DEVELOP A COMPREHENSIVE BLAST EFFECTS DATA BASE
- **RESPONSIBLE AGENCY:**
  - OUSD(A) TWP (OFFICE OF MUNITIONS)
- **PRINCIPAL POC:**
  - TOM HITCHCOCK, (202) 695-1453





# ENHANCED BLAST MUNITIONS TECHNOLOGY BASE DEVELOPMENT

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## BACKGROUND:

- FUEL-AIR EXPLOSIVE (FAE) WEAPONS ARE UNIQUELY SUITED TO MANY MISSIONS INCLUDING CLOSE-IN AIR SUPPORT, ANTI-PERSONNEL, MINE CLEARING, IMPULSE-SENSITIVE TARGETS SUCH AS FUEL DEPOTS, BUILDINGS & BUNKERS, AND MISSILE & RADAR SITES.
- CURRENTLY FAE WEAPONS ARE UNDERUTILIZED IN THE US BECAUSE:
  - POTENTIAL SAFETY HAZARDS FROM VOLATILE FUELS
  - MISPERCEPTIONS CONCERNING RELIABILITY OF CURRENTLY AVAILABLE FAE WEAPONS
  - EFFECTS OF LARGE FAE BOMBS ON AIRCRAFT PERFORMANCE
  - HIGHER COST OF CURRENT GENERATION (TWO-EVENT) FAE WEAPONS
  - LACK OF COMPELLING COMPREHENSIVE EFFECTS DATA BASE
- WORK TO BE COMPLETED WILL ADDRESS THESE PROBLEMS





# ENHANCED BLAST MUNITIONS TECHNOLOGY BASE DEVELOPMENT

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## ● MAJOR PROGRAM ELEMENTS:

- INCREASE FUEL SAFETY
  - DEVELOP FUELS THAT ARE EITHER NON-FLAMMABLE LIQUIDS, GELS, OR ALL-SOLID
- BOOST WEAPON YIELD
  - CONDUCT A FUELS SCREENING STUDY TO IMPROVE BLAST YIELD.
  - INCREASE BLAST PRESSURE AGAINST HARDENED TARGETS BY DEVELOPING FUEL/OXIDIZER HYBRIDS
- INCREASE WEAPON EFFICIENCY
  - MAXIMIZE THE FRACTION OF FUEL THAT DETONATES. OPTIMIZE THE CLOUD SHAPE.
- SINGLE-EVENT FAE
  - DEVELOP AND TEST SPONTANEOUS DETONATION CONCEPTS
- RE-EVALUATE EFFECTS OF BLAST MUNITIONS
  - COMPILE AND COMPLETE A COMPREHENSIVE BLAST EFFECTS DATA BASE



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